DOCUMENT RESUME

95

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TITLE IEA Six-Subject Survey Instruments: Science Tests.

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NOTE 148p.; For related documents, see TM 004 139-163 and ED 034 290 and 300

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DESCRIPTORS *Academic Achievement; Achievement Tests; Biology; Chemistry; College Bound Students; *Comparative Education; *Cross Cultural Studies; Elementary Education; Elementary School Students; Grade 12; High School Students; Junior High Schools; Junior High School Students; Physics; *Science Tests; Secondary Education; Specialists

IDENTIFIERS *International Evaluation Educational Achievement

ABSTRACT

In 1965 the International Association for the Evaluation of Educational Achievement (IEA) inaugurated a cross-national survey of achievement in six subjects: Science, Reading Comprehension, Literature, English as a Foreign Language, French as a Foreign Language, and Civic Education. The overall aim of the project was to use international tests in order to relate student achievement and attitudes to instructional, social, and economic factors, and from the results to establish generalizations of value to policy makers worldwide. Contained here are 22 Science tests measuring achievement in the following areas and for the following student populations: General Science (population I, II, IV); Advanced Science (population IV); Specialist Biology, Chemistry and Physics (population IVS); Practical Science (population II); Practical Science, Biology, Chemistry, and Physics (population IV); and Understanding the Nature of Science (populations II, IV). Population I consists of students aged 10 to 11 years; population II, 14 to 15 years; population IV, students enrolled in the final year of pre-university training; and population IVS, those students in population IV specializing in Science. Answer keys and statistical data can be found in ED 081 639. (RC)

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The basic procedures to be followed in the main testing of the IEA Six-Subject Survey were set out in a series of manuals:

Stage 2	IEA/M1	Manual for National Centers
	IEA/M2	Manual for School Coordinators
	IEA/M3	Manual for Test Administrators
Stage 3	IEA/M1/Stage 3	Manual for National Centers
	IEA/M2/Stage 3	Manual for School Coordinators
	IEA/M3/Stage 3	Manual for Test Administrators

These manuals are available from ERIC Clearinghouse.

The following extracts from these manuals have been appended to this particular IEA instrument to provide researchers with the minimum necessary test instruction information (e.g., such things as the instructions on the practice items and the warnings concerning the amount of time left for the test have been omitted here). For full details, please consult the appropriate manuals.

The Data Bank Instrument Number which appears below is a new number, assigned since the instruments were administered for the purpose of easily linking items in the instruments with the resultant variables in the Data Bank holdings. Each such variable is named in the codebook using the new instrument number and (usually) the number of the item within the instrument from which the variable is derived. The key to the new instrument numbers is as follows:

1: Type of Instrument

- X = Examination (student)
- Q = Questionnaire (student)
- T = Teacher questionnaire
- S = School questionnaire

2: Student Population

1 = I	6 = II and IV
2 = II	7 = I, II and IV
3 = III	8 = I and IV
4 = IV	9 = IV Specialist
5 = I and II	X = NA: Teacher or School questionnaire

3: Subject

- S = Science
- R = Reading Comprehension
- L = Literature
- M = Mother Tongue (Reading Comprehension and Literature)
- E = English as a Foreign Language
- F = French as a Foreign Language
- C = Civic Education
- 2 = All Stage 2 Subjects
- 3 = All Stage 3 Subjects
- 5 = All Stage 2 and Stage 3 Subjects

4-5: Instrument Within Type

One or two characters used when necessary to uniquely identify each instrument when there is more than one instrument of the same type.

Instrument Name Science Test - Section A

Data Bank Instrument Number XIS1

FL 004 138

EISA/K3

Pup 1, p. 4-5

"Now look at the front cover of Booklet 1. Follow carefully while I read the directions to you."

Read the directions to the group, giving them time to mark the answers to the practice questions when these are reached.

Directions:

"This test contains questions dealing with different branches of Science.

.

.

.

Now try these three questions for practice. Fill in the space of your chosen answer on the answer card in section 1."

Then say:

"Are there any questions? You will have 30 minutes for the test. Work as quickly as you can. Do not waste time if you cannot answer a question, but leave it and go on to the next. Open your test booklet and begin."

This test contains questions dealing with different branches of science. Some you will know about from your school work, some from your general knowledge and others you will be able to answer by using commonsense. Others you may not be able to do. Do not waste time over questions you cannot do; leave them and go on to the next question. You can come back to questions you have missed later, if you have time. You may answer even if you are not quite sure, but do not guess blindly.

Each of the questions or incomplete statements in this test is followed by five suggested answers, lettered A, B, C, D, or E. You have to decide which one answer you think best and then on your answer card make a solid pencil mark in the oval containing the correct answer letter.

Here is an example of how to fill in the answer on your answer card. Remember that the examples given on this page will be answered in the section marked 1 on your answer card.

1. How long does the earth take to travel once around the sun?

   A. A day.
   B. A week.
   C. A month.
   D. A year.
   E. None of the above.

Since the earth travels round the sun in a year, the answer space D should be marked. This has been done on the answer card for question 1 in the example section 1.

Now try these three questions for practice. Fill in the space of your chosen answer on the answer card in section 1.

2. Water would be turned into ice by

   A. heating it.
   B. stirring it quickly.
   C. putting salt in it.
   D. pouring it into a shallow dish.
   E. cooling it.

3. Which day of the year in the northern hemisphere has the longest period of daylight?

   A. 21st January.
   B. 21st March.
   C. 22nd December.
   D. 23rd September.
   E. 22nd June.

Sometimes you may be asked to pick out the one wrong answer or the one that does not fit in with the others.

4. Which of the following does NOT belong to the same group as the others?

   A. Eagle.
   B. Fish.
   C. Mouse.
   D. Elephant.
   E. Deer.

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SECTION A

1. The sun is the only body in our solar system that gives off large amounts of light and heat. We see the sun because it is

   A. reflecting light from the sun.
   B. without an atmosphere.
   C. a star.
   D. the biggest object in the solar system.
   E. nearer the earth than the sun.

2. Imagine yourself leaving a rocket ship on the surface of the sun. You would

   A. be overcome with sudden love.
   B. weigh less.
   C. be poisoned by the atmosphere.
   D. shoot off into space.
   E. burn to death with the heat of the sun.

Questions 3 - 5 refer to the following chart which shows some readings taken at different times on three days.

	9.0 a.m.	3.0 a.m.	12.0 Noon	3.0 p.m.	9.0 p.m.
Monday	15° C	17° C	20° C	21° C	18° C
Tuesday	15° C	15° C	15° C	12° C	8° C
Wednesday	8° C	12° C	14° C	14° C	12° C

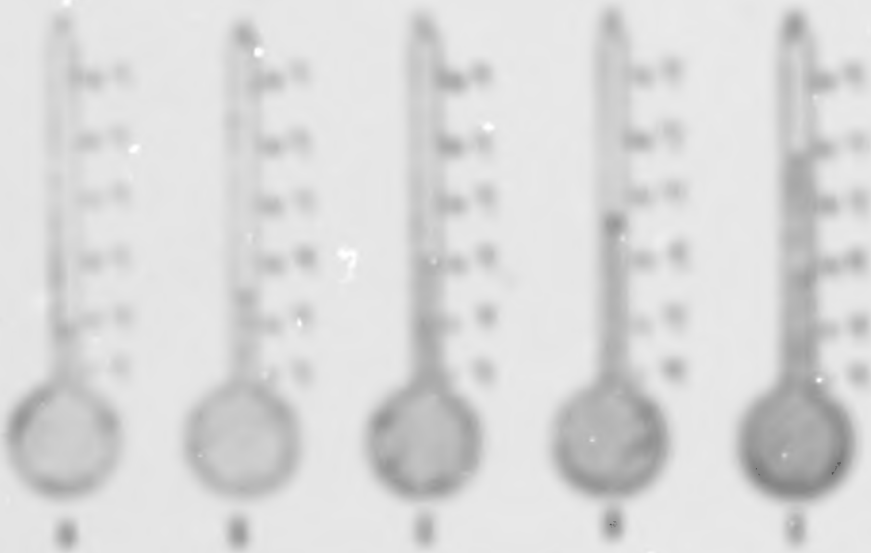
3. To obtain these readings it was necessary to have a

   A. flask and a thermometer.
   B. barometer and a clock.
   C. flask and a clock.
   D. thermometer and a barometer.
   E. thermometer and a clock.

4. When was the highest temperature recorded?

   A. Noon on Monday.
   B. 3.0 p.m. on Monday.
   C. Noon on Tuesday.
   D. Noon on Wednesday.
   E. 3.0 p.m. on Wednesday.

5. [illegible] the following thermometers gives the temperature at 6.15 a.m. on Wednesday?



6. He was not a very kind boss to have. What do you think this happened?

   a. Monday morning.
   b. Monday afternoon.
   c. Tuesday morning.
   d. Tuesday afternoon.
   e. Wednesday afternoon.

[illegible]

[illegible]

5. Which of the following statements is TRUE about water?

   a. It is tasteless and odourless.
   b. It is found in only a few parts of the world.
   c. It is used for many purposes.
   d. It is a solid at room temperature.
   e. It is a compound made up of two elements, oxygen and nitrogen.

6. Two pupils in your class – Susan (girl) and Ali (boy) – want to find out which of these two pupils can run faster. Susan suggests that they should run a 100 metre race, but Ali suggests that they should run a 200 metre race. Which pupil's suggestion is better? Explain your answer.

7. Which of the following statements is TRUE about water?

   a. It is tasteless and odourless.
   b. It is found in only a few parts of the world.
   c. It is used for many purposes.
   d. It is a solid at room temperature.
   e. It is a compound made up of two elements, oxygen and nitrogen.

8. Two pupils in your class – Susan (girl) and Ali (boy) – want to find out which of these two pupils can run faster. Susan suggests that they should run a 100 metre race, but Ali suggests that they should run a 200 metre race. Which pupil's suggestion is better? Explain your answer.

9. Which of the following statements is TRUE about water?

   a. It is tasteless and odourless.
   b. It is found in only a few parts of the world.
   c. It is used for many purposes.
   d. It is a solid at room temperature.
   e. It is a compound made up of two elements, oxygen and nitrogen.

10. Two pupils in your class – Susan (girl) and Ali (boy) – want to find out which of these two pupils can run faster. Susan suggests that they should run a 100 metre race, but Ali suggests that they should run a 200 metre race. Which pupil's suggestion is better? Explain your answer.

11. Which of the following statements is TRUE about water?

    a. It is tasteless and odourless.
    b. It is found in only a few parts of the world.
    c. It is used for many purposes.
    d. It is a solid at room temperature.
    e. It is a compound made up of two elements, oxygen and nitrogen.

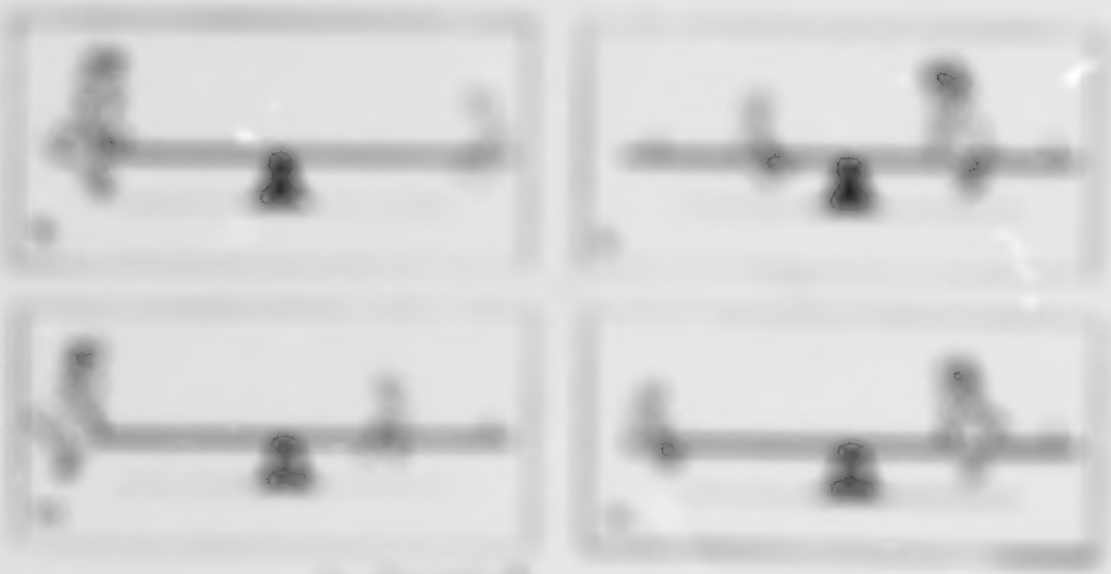
12. Two pupils in your class – Susan (girl) and Ali (boy) – want to find out which of these two pupils can run faster. Susan suggests that they should run a 100 metre race, but Ali suggests that they should run a 200 metre race. Which pupil's suggestion is better? Explain your answer.

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

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SECTION B

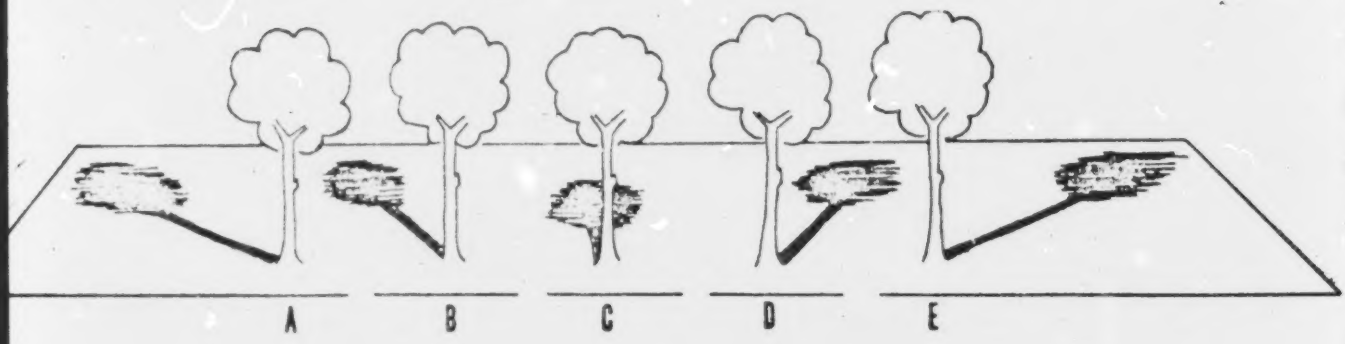
1. Let us imagine you are taking a trip to the moon in a rocket ship. As the rocket ship approaches close to the moon, you would be travelling through

   A. air.
   B. clouds.
   C. gas.
   D. space without air.
   E. time.

2. About how long would it take a rocket ship to reach the moon?

   A. Two hours.
   B. Several hours.
   C. A few days.
   D. A light-year.
   E. Several years.

3. At different times during a sunny day a tree was seen to have cast a shadow of different length as shown in the diagrams below. Which diagram shows the shadow at mid-day (12.00 hours)?



4. The reason that milk kept in a refrigerator does not go sour is that the cold

   A. changes the water of the milk into ice.
   B. separates the cream.
   C. slows down the action of bacteria.
   D. keeps flies away.
   E. causes a skin to form on the surface.

5. Which one of the following plants is <u>NOT</u> grown for food?

   A. Wheat.
   B. Rice.
   C. Potato.
   D. Sugar cane.
   E. Cotton.

6. John brought the skull of a dead animal to school. His teacher said she did not know what the animal was but she was sure that it was one that preyed on other animals for its food. Which clue, do you think, led her to this conclusion?

A. The eye sockets faced sideways.
B. The skull was much longer than it was wide.
C. There was a projecting ridge along the top of the skull.
D. Four of the teeth were long and pointed.
E. The jaws could work sideways as well as up and down.

7. While Joe was sitting under a tree, he watched a bird getting insects from between the cracks of the bark. Which drawing shows the kind of beak this bird had?

8. If, immediately before and after a 50 metre race, your pulse and breathing rates were taken, you would expect to find

A. no change in pulse but decrease in breathing rate.
B. an increase in pulse but no change in breathing rate.
C. an increase in pulse and breathing rate.
D. a decrease in pulse and breathing rate.
E. no change in either.

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9. Flowers cannot usually produce seeds unless

A. they are visited by insects.
B. they appear in the summer.
C. they are on plants growing in good soil.
D. they produce nectar.
E. suitable pollen is placed on their stigmas.

10. Some seeds germinate best in the dark, others in the light, while others germinate equally well in the dark or the light. If you wanted to find out by means of an experiment to which group a certain kind of seed belonged, you would sow some of the seeds on damp blotting paper and

A. keep them in a warm place in the dark.
B. keep one batch in the light and another in the dark.
C. keep them in a warm place in the light.
D. sow some on dry blotting paper and keep them in the light.
E. sow some on dry blotting paper and keep them in the dark.

11. Which one of the following animals does <u>not</u> usually live in the kind of place shown?

A. Zebras on grassy plains.
B. Seals on rocky sea shores.
C. Beavers on river banks.
D. Monkeys in forests.
E. Moles in rocky places.

12. John gave some reasons why kettles and kitchen pans are often made of copper. Which of his reasons was wrong?

A. Copper is a bad conductor of heat.
B. Copper is a tough metal.
C. Copper can be polished to give a pleasing finish.
D. Copper is easy to shape.
E. Copper does not dissolve in hot water.

13. What gas in the air is essential for us to breathe in order to live?

A. Nitrogen
B. Oxygen.
C. Carbon dioxide.
D. Hydrogen.
E. Water vapour.

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14. When Tom threw his rubber ball into the air, it came back to the ground because

A. the air pushed it back.
B. rubber always bounces back.
C. the earth pulled it back.
D. the air is very light.
E. the earth is a large magnet.

15. Ann was playing with a bubble pipe. When the bubble was the size of the one in the picture, she took the pipe out of her mouth. What do you think happened to the bubble after that?

A. It got larger for a time and then stayed at this size.
B. It got smaller for a time and then stayed at this size.
C. It got smaller and smaller and disappeared into the pipe.
D. It stayed on the pipe without getting larger or smaller.
E. It became larger and larger until it burst.

16. Some children had made a space-ship from wooden boxes. Today they are making plans for their first trip to the moon. Judy says, "Scientists tell us that the moon has no atmosphere." Jack asks, "How can we keep in touch with each other?" Which one of the children's ideas is best?

A. Judy says, "Let's take a garden hose to use as a speaking tube."
B. Phil says, "Let's find out from Mr. Jones where he got his hearing aid. We could take some of those."
C. Joe says, "Let's make sure we take enough walkie-talkies with plenty of fresh batteries."
D. Betty says, "Let's bring along those large megaphones like the cheerleaders use."
E. Joan says, "Our voices would carry better on the moon and there would be no problem."

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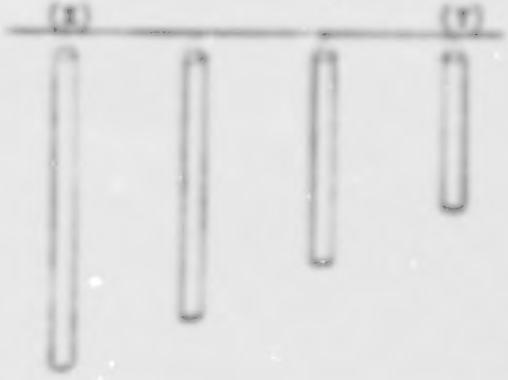
17. Betty was trying to take the metal screw-top off a jar of jam but it wouldn't turn. What should Betty do in order to open the jar with the least risk of breaking it?

A. Force the cap off with a screw driver.
B. Run hot water on the glass part of the jar.
C. Run cold water on the cap.
D. Hammer the cap off.
E. Run hot water on the cap.

18. As part of an investigation a cupful of water and a similar cupful of petrol were placed on a window sill on a hot sunny day. A few hours later it was observed that both the cups had less liquid in them and that there was less petrol left than water. The experiment showed that

A. all liquids evaporate.
B. petrol gets hotter than water.
C. some liquids evaporate faster than others.
D. liquids will only evaporate in sunshine.
E. water gets hotter than petrol.

19. Some boys made a set of chimes by cutting four pieces of pipe of different lengths from a long metal pipe and hanging them as shown in the picture below. Which of the pipes gave the lowest note when they struck it with a hammer?



A. Pipe (X)
B. Pipe (Y)
C. All gave the same note.
D. You cannot tell without trying.
E. It depends on where you hit it.

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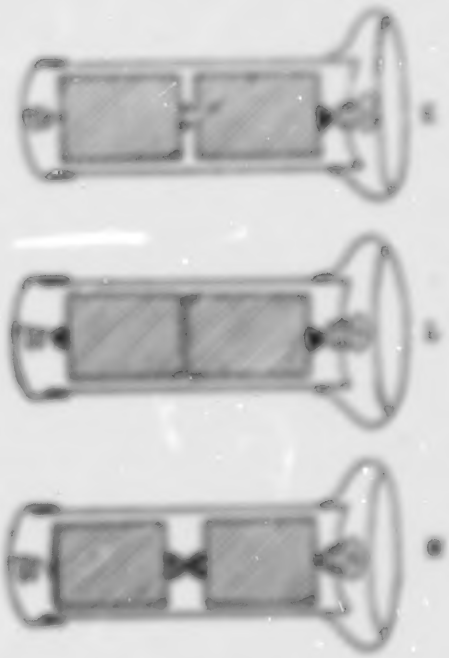
35. A flashlight holds two cells. In order to make it work, in which of the following ways must we place the cells?



A. As in I
B. As in II
C. As in III
D. Either as in I or II
E. None of these would do.

END OF SECTION 8

DO NOT TURN OVER UNTIL YOU ARE TOLD TO DO SO

[illegible]

[illegible]

7. [illegible]

   a. [illegible]
   b. [illegible]
   c. [illegible]
   d. [illegible]
   e. [illegible]

8. [illegible]

   a. [illegible]
   b. [illegible]
   c. [illegible]
   d. [illegible]
   e. [illegible]

9. [illegible]

   a. [illegible]
   b. [illegible]
   c. [illegible]
   d. [illegible]
   e. [illegible]

10. [illegible]

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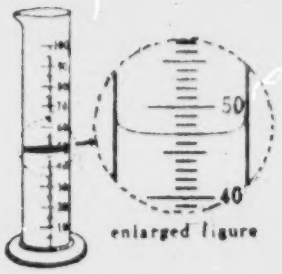
21. Mary and Jane each bought the same kind of rubber ball. Mary said, "My ball bounces better than yours." Jane replied, "I'd like to see you prove that." What should Mary do?

A. Drop both balls from the same height and notice which bounces higher.
B. Throw both balls against a wall and see how far each ball bounces off the wall.
C. Drop the two balls from different heights and notice which bounces higher.
D. Throw the balls down against the floor and see how high they bounce.
E. Feel the balls by hand to find which is the harder.

22. The measuring cylinder contains a certain volume of water. The enlarged figure shows a view of the surface of the water as seen from the side. What is the volume of the water ?



A. 50 cm^3
B. 49 cm^3
C. 48 cm^3
D. 47 cm^3
E. 46 cm^3

23. It is said that, dressed in the same way, a man would be able to jump higher on the Moon than on the Earth. Which of the following is the best explanation of this?

A. His mass is less when he is on the Moon.
B. The force of gravity is less on the Moon than on the Earth.
C. His distance from the Earth is greater when he is on the Moon.
D. There is no air on the Moon to offer resistance.
E. Newton's Laws of Motion do not apply on the Moon.

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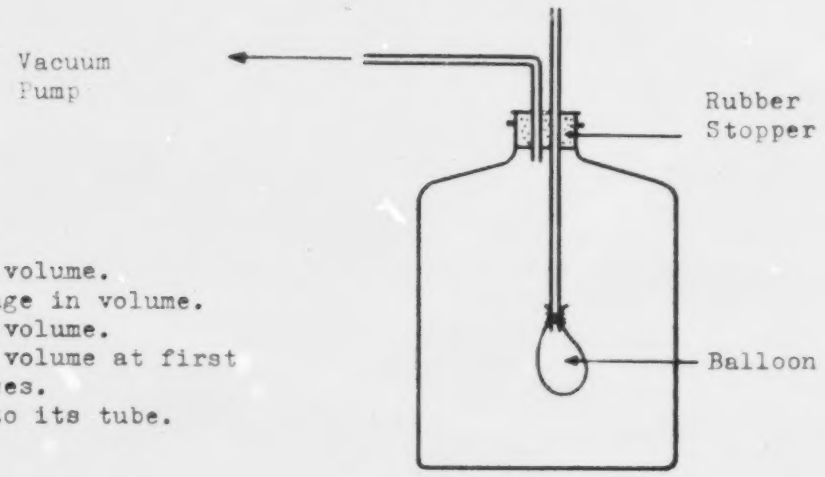
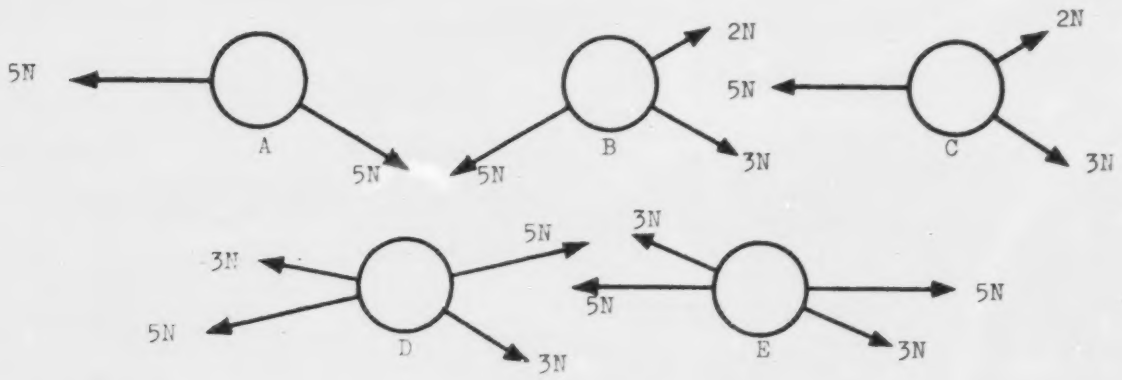
24. What happens to the balloon when the air in the bottle is extracted by a vacuum pump?



A. It increases in volume.
B. It does not change in volume.
C. It decreases in volume.
D. It decreases in volume at first but then increases.
E. It is sucked into its tube.

25. The diagrams show rings being pulled by different forces in the same plane. Which ring is in equilibrium under the action of the given forces?



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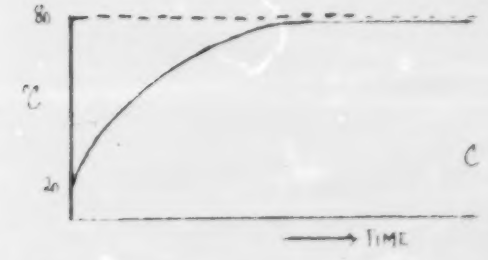
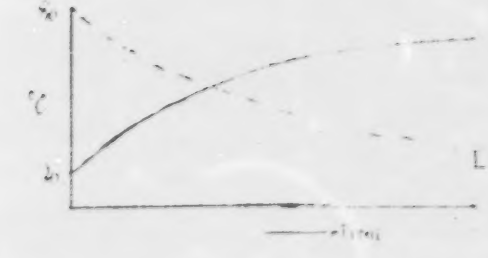
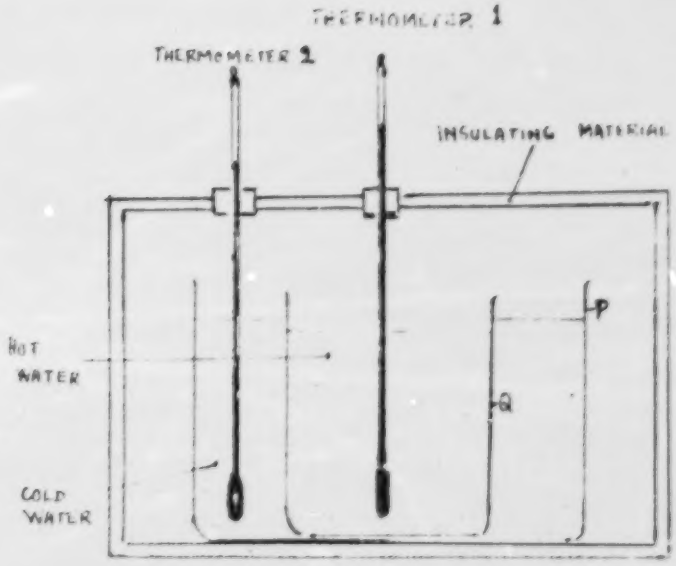
26. Using the apparatus shown in the figure below, 100g of water at 20° C was poured into the outer container P and its temperature read at intervals from thecomometer 2. At the same time 100g of water at 80° C was poured into the inner container Q and its temperature read at intervals from thermometer 1. Which of the following graphs best represents the changes in the temperatures of the water in the two containers.







THERMOMETER 1

THERMOMETER 2

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27. Under which of the following conditions does water evaporate fastest?

A. On a hot and dry day.
B. On a hot and moist day.
C. On a cold and dry day.
D. On a cold and moist day.
E. On a calm and moist day.

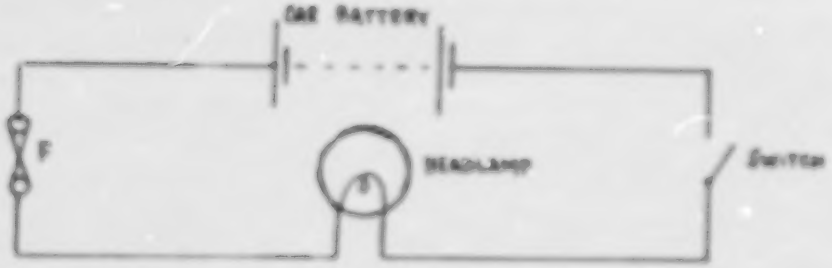
28. The crews of two ships at sea can communicate with each other by shouting through loudhailers. It is impossible for the crews of spaceships a similar distance apart in space to do this because

A. the temperature is too low.
B. the sound is reflected.
C. the pressure is too high inside the space ship.
D. the sound barrier has been broken.
E. there is no air.

29. Jane was trying to find out which things she could pick up with a magnet. With which one of the following would she NOT succeed?

A. A magnetic compass needle.
B. A steel screw.
C. An iron nail.
D. A sewing needle.
E. A brass paper fastener.

30. The following diagram shows a lighting circuit in a car.



Fuse F would most probably be made of

A. thin wire with low melting point.
B. thick wire with low melting point.
C. thick wire with high melting point.
D. thin wire with high melting point.
E. the same wire as the connecting leads.

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Questions 31 and 32 refer to the following diagram which shows an arrangement of apparatus which can be used to show that an animal gives out carbon dioxide in respiration.

1 contains a substance which removes carbon dioxide from air.
2 and 4 both contain a liquid which changes in appearance when carbon dioxide passes through it.

31. Of the following kinds of containers for the animal which one would give the quickest result?

A. A small container.
B. A large container.
C. A container in bright light.
D. A container covered with a dark cloth.
E. A container in which the air is kept moist by means of wet cotton wool.

32. If air leaked into chamber 3, which one of the following effects would be seen?

A. The liquid in 4 would change more rapidly.
B. The rate of bubbling in 2 would slow down or stop.
C. The rate of bubbling in 4 would slow down or stop.
D. Liquid would pass from 4 into 3.
E. The liquid in 2 would change more rapidly.

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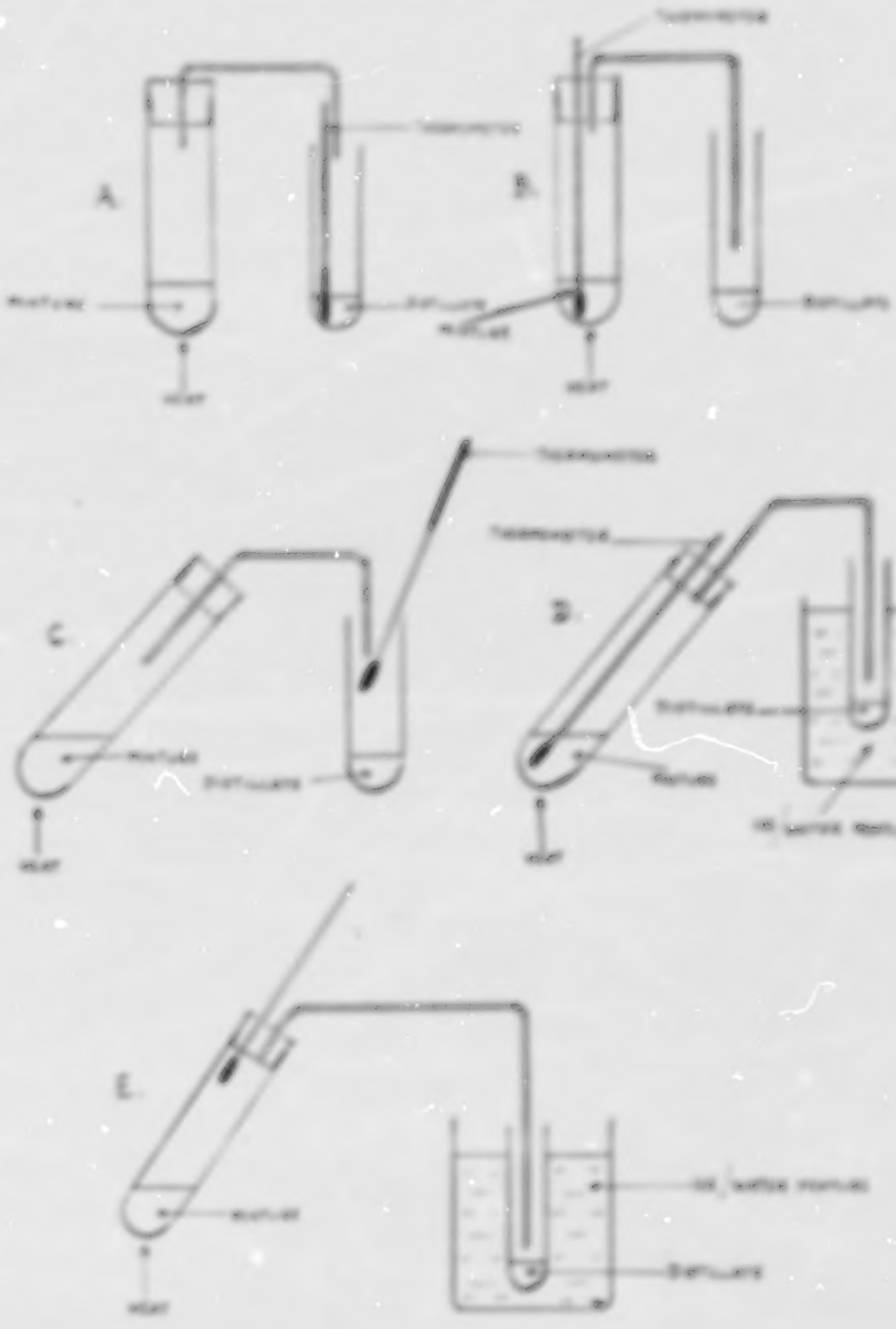
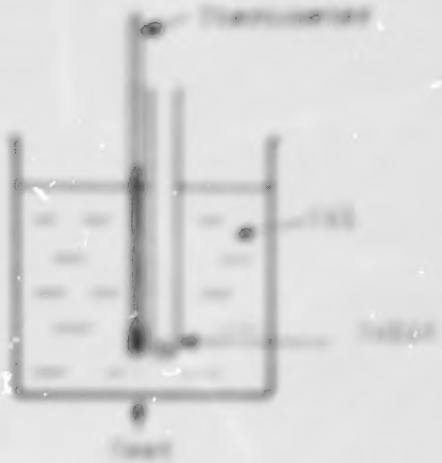
11. A small sample of a mixture of liquids with different boiling points is to be separated into its components by distillation. Which of the following sets of apparatus is most suitable for carrying this out and for determining the temperature at which each of the components of the mixture boils?



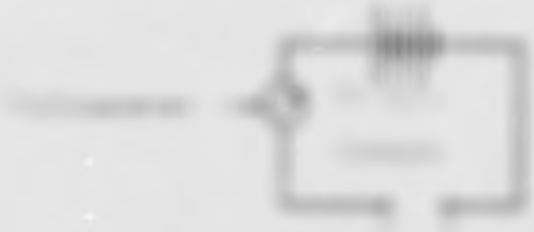

Thermometer
Oil
Heat
Test

[illegible]

[illegible] It is useful to distinguish the manner of a legged trip by a [illegible] pivot of the [illegible] on a plane [illegible] surface.

1. The swing foot hits the ground,
2. The trailing foot is unloaded,
3. The trailing foot [illegible],
4. The swing foot [illegible],
5. Arrest [illegible] the [illegible].

Fig. 1 A system of hydraulic accessories made to be coupled to form any desired circuit with only four main connecting elements, being of the right-angle and straight-through types.



[illegible]

[illegible]

[illegible]

[illegible]

[redacted]

[redacted]

[redacted]

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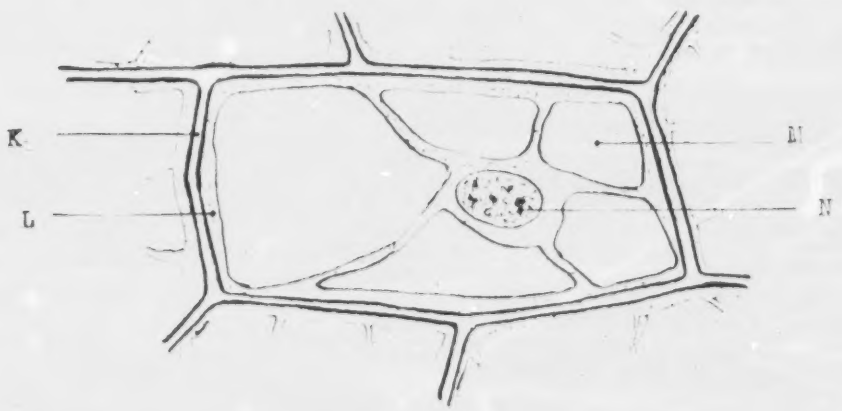
4. Tom wanted to learn which of three types of soil- clay, sand or loam- would be best for growing beans. He found three flowerpots, put a different type of soil in each pot, and planted the same number of beans in each, as shown in the drawing. He placed them side by side on the window sill and gave each pot the same amount of water.

Why was Tom's experiment NOT a good one for his purpose?

A. The plants in one pot got more sunlight than the plants in the other pots.
B. The amount of soil in each pot was not the same.
C. One pot should have been placed in the dark.
D. Tom should have used different amounts of water.
E. The plants would get too hot on the window sill.

5. The drawing represents a plant cell. In which of the four regions marked might chloroplasts be found?



A. In K only
B. In L only
C. In M only
D. In N only
E. In both K and L

6. The energy for photosynthesis is generally obtained from

A. chlorophyll.
B. chloroplasts.
C. sunlight.
D. carbohydrates.
E. carbon dioxide.

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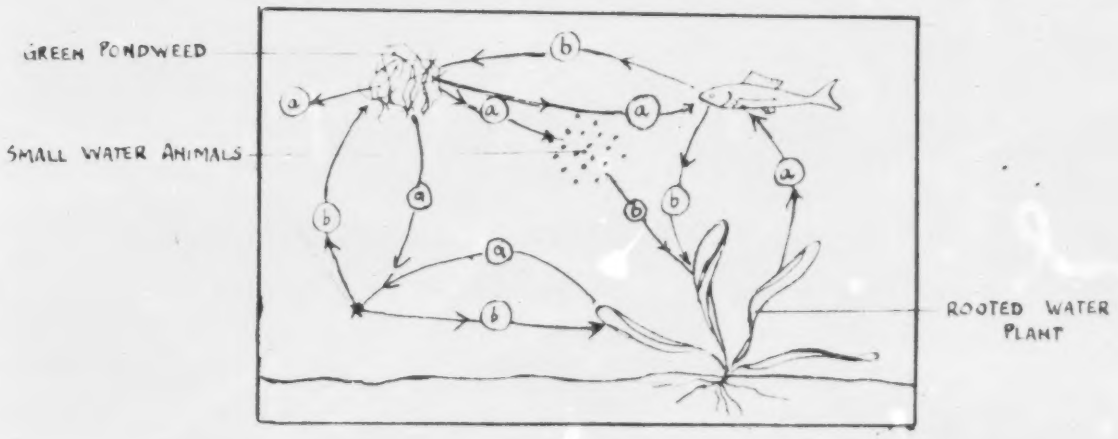
7. The diagram below shows an example of interdependence among aquatic organisms. During the day the organisms either use up or give off (a) or (b) as shown by the arrows. Choose the right answer for (a) and (b) from the alternatives given.



A. a is oxygen and b is carbon dioxide.
B. a is oxygen and b is carbohydrate.
C. a is nitrogen and b is carbon dioxide.
D. a is carbon dioxide and b is oxygen.
E. a is carbon dioxide and b is carbohydrate.

8. What does an active muscle, that is, a muscle which is doing work, give up to the blood?

A. Carbon dioxide.
B. Oxygen.
C. Nitrogen.
D. Vitamin B.
E. Glucose.

9. The Andes are high mountains in South America and their inhabitants live and work at high altitudes. These people have almost twice as many red corpuscles in their blood as do the people living in the valleys. Which one of the following is the best explanation of this?

A. In the Andes there is less air pressure acting on the inhabitants' blood vessels and so new red corpuscles can be produced more quickly.
B. Because there is a smaller amount of oxygen in the air of the Andes the inhabitants breathe more deeply in order to increase the total amount of oxygen in their lungs.
C. In the Andes there is less oxygen entering the lungs of the inhabitants so that an increase in the number of red corpuscles enables a larger proportion of this oxygen to be absorbed.
D. Inhabitants of the Andes need more red corpuscles to transport oxygen through the blood vessels because there is less oxygen in the air they breathe.
E. The lower air pressure in the Andes causes blood to circulate more quickly through the blood vessels and so more red cor-

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10. All of the following are aspects of the reproductive process. Which one of them must occur before we can be certain that fertilisation has taken place?

A. A male organism must find a mate.
B. Reproductive organs must be produced.
C. The nucleus of a male gamete must fuse with that of a female gamete.
D. A spermatozoon must reach an egg cell.
E. A female gamete must provide a store of food for the embryo.

11. Paint applied to an iron surface prevents the iron from rusting by

A. preventing nitrogen from coming in contact with the iron.
B. reacting chemically with the iron.
C. preventing carbon dioxide from coming in contact with the iron.
D. making the surface of the iron smoother
E. preventing oxygen and moisture from coming in contact with the iron.

---

12. Flour is a fine powder obtained by grinding wheat or other cereal grains. A pile of grain burns only very slowly whereas flour dust suspended in air is explosive. Which of the following is the best explanation of this?

A. The heat produced when small particles burn is greater than the heat produced by the burning of large particles of the same substance.
B. Grinding the grain changes its chemical composition.
C. For the same quantity of the material, small particles have a greater surface area in contact with air than large particles.
D. Small particles possess more energy than large particles.
E. The flour burns completely whereas the pile of grain does not.

13. Two given elements combine to form a poisonous compound. Which of the following conclusions about the properties of these two elements can be drawn from this information?

A. Both elements are certainly poisonous.
B. At least one element is certainly poisonous.
C. One element is poisonous, the other is not.
D. Neither element is poisonous.
E. Neither element need be poisonous.

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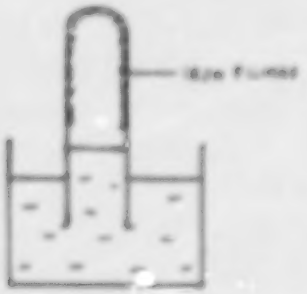
14. A test tube coated with iron filings on the inside was clamped vertically in a beaker of water. Water gradually rose a short distance in the test tube as shown in the sketch.



Of the following, the best explanation of this is that

A. water condenses inside the tube.
B. the iron gives off a gas which dissolves in the water.
C. the rust which replaces the iron takes up less space than the iron.
D. the iron reacts with oxygen from the air inside the tube.
E. oxygen from inside the tube dissolves in the water.

15. The presence of ions in a given water solution is most directly detected by

A. finding out if the solution conducts electricity.
B. measuring the density of the solution and comparing it with those of the pure solute and water.
C. finding out if the solution has an electric charge.
D. evaporating the solution and testing the residue for conductivity.
E. adding an ionic substance and seeing if there is a reaction.

16. Which one of the following elements forms an oxide which turns red litmus paper blue when added to water?

A. Phosphorus.
B. Carbon.
C. Iron
D. Sulphur.
E. Calcium.

17. In which of the following cases will heat be generated?

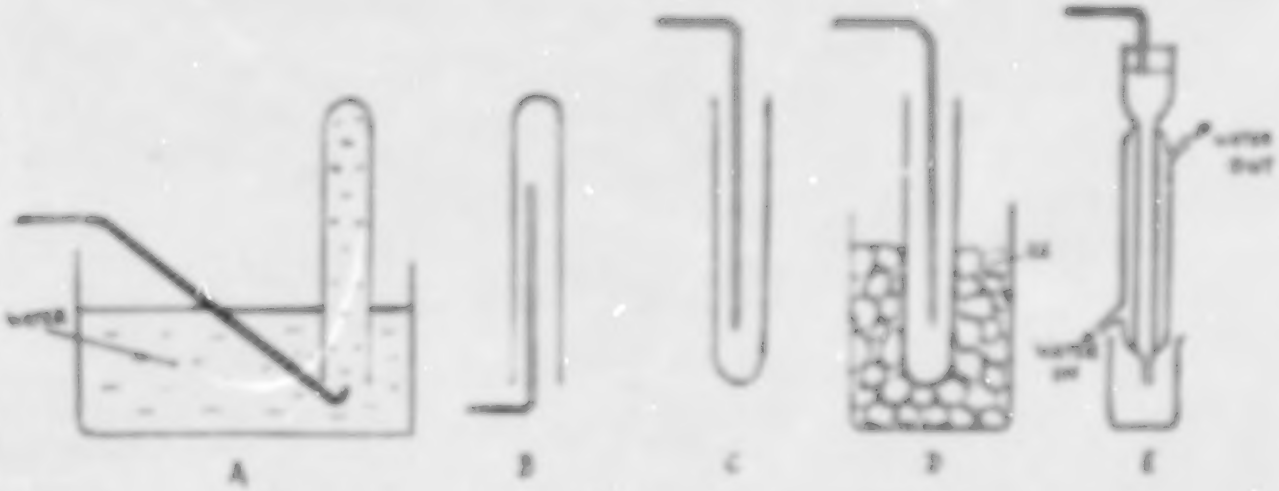
1. When sodium hydroxide dissolves in water.
2. When water is decomposed.
3. When ice thaws.
4. When water evaporates.
5. When concentrated sulphuric acid dissolves in water.

A. 1 and 2.
B. 1 and 5.
C. 3 and 4.
D. 3, 4 and 5.
E. 2, 3, 4 and 5.

18. You find what appear to be salt (sodium chloride) deposits. In order to learn what the deposits are, which of the following items of information would be most valuable?

A. Percentage of sodium chloride in the sample.
B. Percentage of magnesium chloride in the sample.
C. Specific gravity of the sample.
D. Chemical composition of the sample.
E. Solubility in water of the sample.

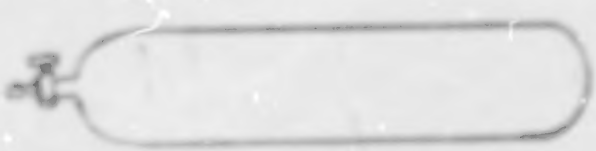
19. Which is the most suitable apparatus from those shown below for collecting pure oxygen gas by a student in a school laboratory?



20. Which one of the following substances does not consist mainly of carbon atoms?

A. Diamond.
B. Graphite.
C. Soot.
D. Ruby.
E. Charcoal.

21. An iron container is evacuated and weighed. Then it is filled with hydrogen gas and weighed again.



The weight of the container full of hydrogen compared to the weight of the evacuated container is

A. less.
B. greater.
C. the same.
D. greater or less depending on the volume of the gas in the container.
E. greater or less depending on the temperature of the gas in the container.

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22. Ann was playing with a bubble pipe. When the bubble was the size of the one in the picture, she took the pipe out of her mouth. What do you think happened to the bubble <u>after</u> that?

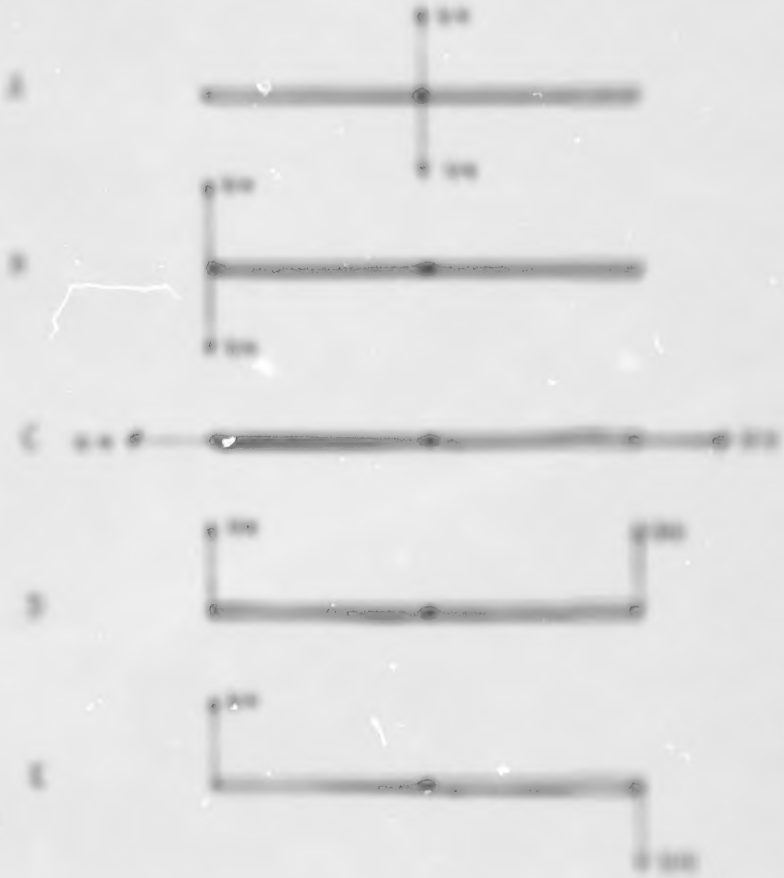
A. It got larger for a time and then stayed at this size.
B. It got smaller for a time and then stayed at this size.
C. It got smaller and smaller and disappeared into the pipe.
D. It stayed on the pipe without getting larger or smaller.
E. It became larger and larger until it burst.

23. The objects P, Q and R of weight 10N, 20 N and 7 N, are hung with a light thread as shown in the figure.

What is the tension between P and Q?

A. 40 N
B. 35 N
C. 27 N
D. 15 N
E. 7 N

20. A uniform rod, pivoted at its centre, is acted on by two forces in the same plane. In which case is there a turning effect?



21. The advantage of using a lever such as that shown in the figure to raise a weight W instead of lifting it directly is that

A. less energy is required.
B. it is quicker.
C. less force is needed.
D. less power is required.
E. less work has to be done.

[illegible]

[illegible] Sami [illegible] a set of pulses by cutting four pieces of pipe of different lengths from a long metal pipe and [illegible] them as shown in the picture below. Which of the pipes gave the highest note when Sami struck it with a hammer?

A. Pipe [illegible].
B. Pipe [illegible].
C. All gave the same note.
D. Too many variables.
E. It happens as shown you hit it.

[illegible] Four balls, [illegible] and [illegible] shown to scale in the figures, are made of different materials, but have the same weight.

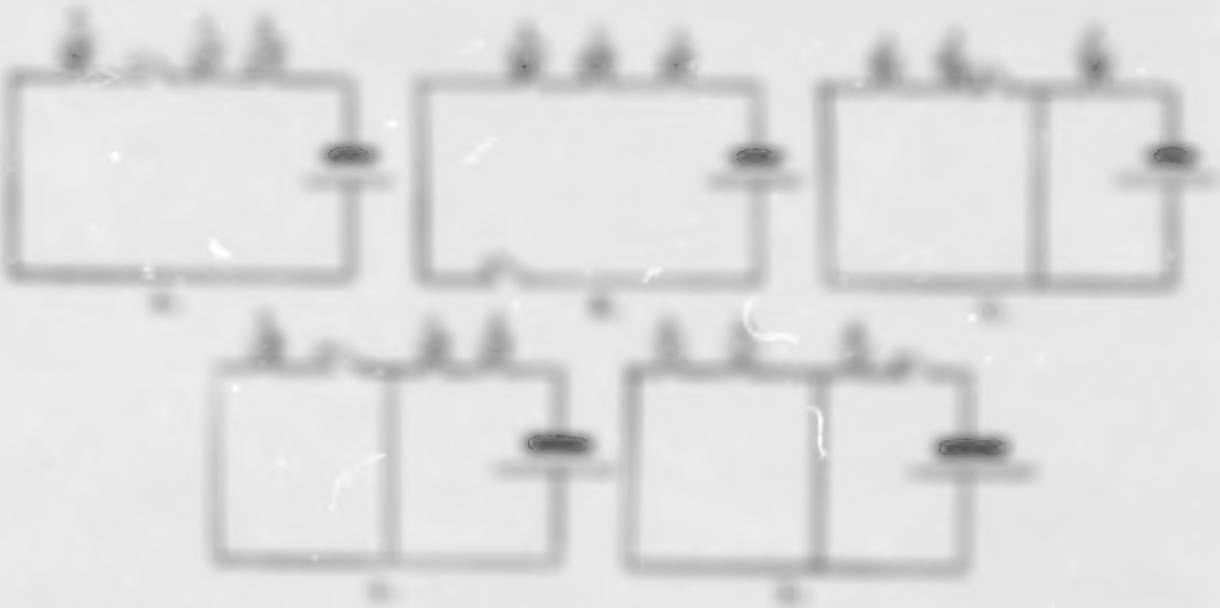
Which one of the following statements about their densities is true?

A. They all have the same density.
B. You cannot tell anything about their densities.
C. Which one has the highest density depends on how the volumes are measured.
D. [illegible] has the highest density.
E. [illegible] has the highest density.

[illegible] A metal ring having exactly the same diameter as a hole in a block of wood is found to [illegible] when it is heated.

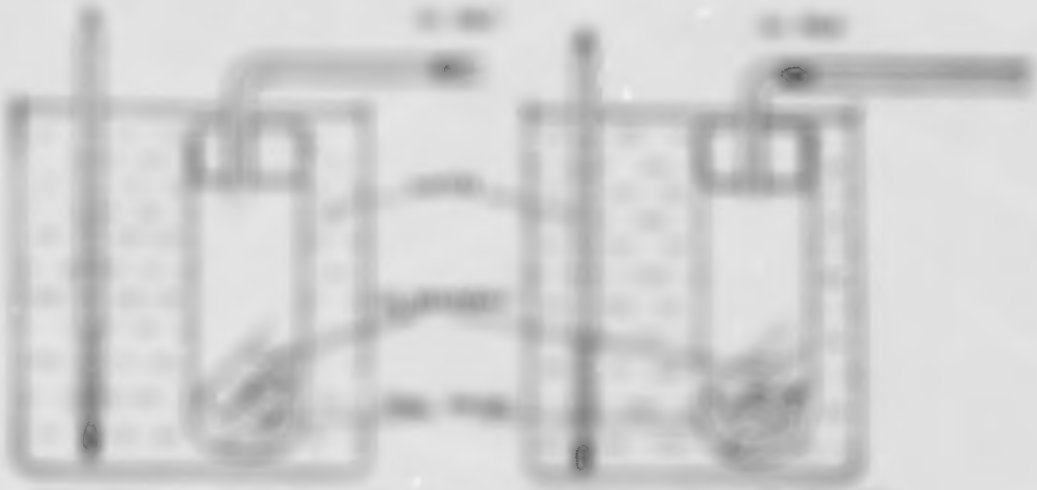
A. metal expands [illegible] when heated.
B. metal molecules move more [illegible] when heated.
C. metal contracts [illegible] when cooled.
D. [illegible] is a better heat conductor than metal.
E. A vacuum surrounds [illegible] a colder surface than a rough one.

[illegible]



[illegible]

[illegible]



(a) (i) Name the apparatus used to measure the volume of gas collected in the experiment. [1 mark]

(ii) Explain why the gas in A is collected over water. [1 mark]

(b) Write an equation for the reaction that occurs in the boiling tube. [2 marks]

(c) Why is the gas not collected in the first few bubbles? [1 mark]

(d) (i) Name the gas that is collected in the experiment. [1 mark]

(ii) Describe a test for the gas named in (i) above. [2 marks]

(e) Why is the gas collected in the experiment not pure? [1 mark]

(f) Name the type of this reaction. [1 mark]

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IEA SIX-SUBJECT SURVEY INSTRUMENTS

The basic procedures to be followed in the main testing of the IEA Six-Subject Survey were set out in a series of manuals:

Stage 2 IEA/M1 Manual for National Centers
IEA/M2 Manual for School Coordinators
IEA/M3 Manual for Test Administrators

Stage 3 IEA/M1/Stage 3 Manual for National Centers
IEA/M2/Stage 3 Manual for School Coordinators
IEA/M3/Stage 3 Manual for Test Administrators

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NATIONAL INSTITUTE OF EDUCATION
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These manuals are available from ERIC Clearinghouse.

The following extracts from these manuals have been appended to this particular IEA instrument to provide researchers with the minimum necessary test instruction information (e.g., such things as the instructions on the practice items and the warnings concerning the amount of time left for the test have been omitted here). For full details, please consult the appropriate manuals.

The Data Bank Instrument Number which appears below is a new number, assigned since the instruments were administered for the purpose of easily linking items in the instruments with the resultant variables in the Data Bank holdings. Each such variable is named in the codebook using the new instrument number and (usually) the number of the item within the instrument from which the variable is derived. The key to the new instrument numbers is as follows:

1: Type of Instrument

E = Examination (student)
Q = Questionnaire (student)
T = Teacher questionnaire
S = School questionnaire

2: Student Population

1 = I
2 = II
3 = III
4 = IV
5 = I and II
6 = II and IV
7 = I, II and IV
8 = I and IV
S = IV Specialist
N = NA: Teacher or School questionnaire

3: Subject

S = Science
R = Reading Comprehension
L = Literature
M = Mother Tongue (Reading Comprehension and Literature)
E = English as a Foreign Language
F = French as a Foreign Language
C = Civic Education
2 = All Stage 2 Subjects
3 = All Stage 3 Subjects
5 = All Stage 2 and Stage 3 Subjects

4-5: Instrument Within Type

One or two characters used when necessary to uniquely identify each instrument when there is more than one instrument of the same type.

Instrument Name Science Test Section A

Data Bank Instrument Number E4SA

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IEA/M3
Pop IV, p. 3-4

"Now look at the front cover of Booklet 10. Follow carefully while I read the directions to you."
Read the directions to the group, giving them time to mark the answers to the practice questions when these are reached.
Directions:-
"This test contains questions dealing with different branches of Science.

.
.
.

Now try the next three questions for practice. Fill in the space of your chosen answer on the answer card in Section L."
"We are now ready to begin Section A. The answers to the test are to be placed in the section marked A on your answer card."
Indicate the appropriate section of the answer card. Then say:-
"You will have 60 minutes for this test. Work as quickly as you can. Do not waste time if you cannot answer a question, but leave it and go on to the next. Are there any questions?"

SCIENCE E4SA

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This test contains questions dealing with different branches of Science. Some you will know about from your school work, some from your general knowledge and others you will be able to answer by using commonsense. Others you may not be able to do. Do not waste time over questions you cannot do; leave them and go on to the next question. You can come back to questions you have missed later, if you have time. You may answer even if you are not quite sure, but do not guess blindly.

Each of the questions or unfinished statements in this test is followed by five suggested answers, lettered A,B,C,D, and E. You have to decide which one answer you think best and then on your answer card make a solid pencil mark in the oval containing the correct answer letter.

Here is an example of how to fill in the answer on your answer card. Remember that the examples given on this page are to be answered in the section marked L on your answer card.

1. How long does the earth take to travel once around the sun?

   A. A day.
   B. A week.
   C. A month.
   D. A year.
   E. None of the above.

Since the earth travels round the sun in a year, the answer space D should be marked. This has been done on the answer card for the question 1 in the example section L.

Now try these three questions for practice. Fill in the space of your chosen answer on the answer card in section L.

2. Water would be turned into ice by

   A. heating it.
   B. stirring it quickly.
   C. putting salt in it.
   D. pouring it into a shallow dish.
   E. cooling it.

3. Which day of the year in the southern hemisphere has the longest period of daylight?

   A. 21st January.
   B. 21st March.
   C. 22nd December.
   D. 23rd September.
   E. 22nd June.

Sometimes you may be asked to pick out the one wrong answer or the one that does not fit in with the others.

4. Which of the following does NOT belong to the same group as the others?

   A. Eagle.
   B. Lion.
   C. Mouse.
   D. Elephant.
   E. Deer.

DO NOT TURN OVER UNTIL YOU ARE TOLD TO DO SO.

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1. A student wrote the following note on a laboratory project.

"Using a cork-borer I obtained several cylinders from a large potato. The cylinders were 7 cm long and 0.5 cm in diameter. I kept them on a dry plate and measured them again on the following day. I found that all of them had become shorter and thinner."

The student then put the cylinders into a beaker of tap water and wrote,
"If I measure them tomorrow I shall find that they have all returned to their original size."
In writing this second sentence the student was

A. making a statement of fact.
B. making an observation.
C. drawing a tentative conclusion.
D. describing an experimental procedure.
E. making a hypothesis.

2. Which of the following features present in an animal would make you certain it was a mammal?

A. A vertebral column.
B. Small tufts of "hair - like" bristles on its skin.
C. Two pairs of limbs.
D. Two pairs of milk glands.
E. Five digits on each fore-limb.

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Questions 3 and 4 refer to the following data.

Several different parts of plants were placed in sealed containers of equal volume. The amounts of CO_2 (carbon dioxide) used by the plant parts under different conditions were measured and recorded.

Container	Plant	Plant Part	Vol. of Plant Part (cm^3)	Colour of Light	Temp. (°C)	Time Elapsed (days)	CO_2 Used (cm^3)
1	Myrtle	Leaf	100	Red	15	2	150
2	Myrtle	Leaf	100	Red	27	2	200
3	Myrtle	Stem	100	Blue	21	2	50
4	Oak	Root	100	Blue	27	3	0
5	Oak	Leaf	100	Orange	27	2	100
6	Oak	Leaf	100	Orange	27	3	150

Assume that the experimental conditions not listed were identical in all six containers.

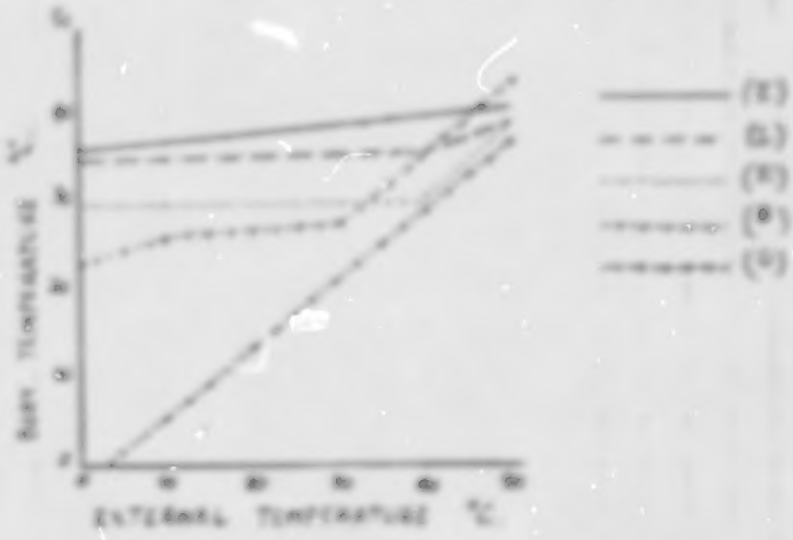
3. On the basis of the data in the table, one could properly compare the amount of CO_2 used in one day by

   A. myrtle leaves at 15°C and at 27°C.
   B. myrtle stems and myrtle leaves.
   C. myrtle leaves in red light and in orange light.
   D. oak leaves in orange light and in blue light.
   E. oak leaves at 15°C and at 27°C

4. Which one of the following statements about the use of CO_2 by oak leaves would be supported by the given data?

   A. They use more CO_2 in orange light than in blue light.
   B. They use more CO_2 at 27°C than at 15°C.
   C. They use more CO_2 per day than did the myrtle leaves.
   D. They use an average of 50 cm^3 CO_2 each day.
   E. They use 50 cm^3 of CO_2 each day.

3. The graph shows the results obtained when the changes in body temperature resulting from changes in external air temperature for various animals were being investigated.



Which of these curves is most likely to represent the results obtained from a lizard?

A. X
B. L
C. M
D. S
E. O

4. A lizard in a laboratory at 20°C was placed close to three temperature controlled areas, one at a temperature of 10°C, one at a temperature of 37°C and one at a temperature of 15°C. It always moved to the 37°C area.

This behaviour is an example of

A. a response to a stimulus.
B. reasoning.
C. a reflex act.
D. geotropism
E. thigmotaxis

7. All of the following are parts of the reproductive process. Which one of them must occur before we can be certain that fertilization has taken place?

   A. A male gamete must find a mate.
   B. Reproductive organs must be produced.
   C. The nucleus of a male gamete must fuse with that of a female gamete.
   D. A spermatozoon must reach an egg cell.
   E. A female gamete must provide a store of food for the embryo.

8. Which of the following is a correct statement about hibernating animals?

   A. There is no life in any part of the animal.
   B. The animal ceases to breathe.
   C. The animal is expending energy just not even it returns to active life.
   D. The animal's body temperature is higher than when it is active.
   E. The animal is using less energy than during the period of active life.

9. When 10 g of dilute sulphuric acid and [illegible] 1 g of zinc is in open test tube, hydrogen gas is [illegible]. What was the weight of the contents of the test tube after the reaction had completed?

   A. Slightly more than 10 g.
   B. Slightly less than 10 g.
   C. Equal to 10 g.
   D. Slightly less than 11 g.
   E. Equal to 11 g.

10. A sample of oxygen gas in a plastic bag weighed 0.32 g. A sample of nuclear gas in an identical bag, under the same conditions of temperature and pressure, weighed 0.70 g.

    Atomic weight of oxygen = 16.

    What is the weight of 1 mole of the second gas?

    A. 17 g.
    B. 18 g.
    C. 40 g.
    D. 56 g.
    E. 44 g.

[illegible]

[illegible]

[illegible]

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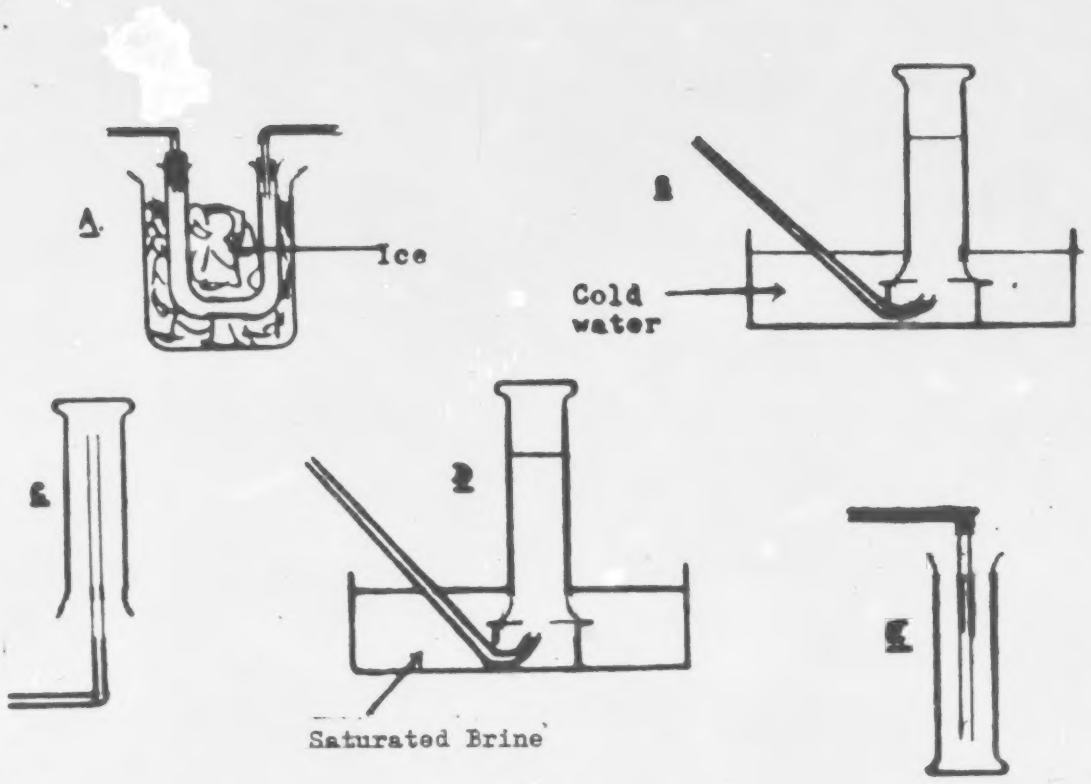

A substance has a boiling point of 21°C. In its gaseous state it is denser than air and soluble in water. From the diagrams above select the one representing the most suitable apparatus by which to collect a sample of the substance.

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32. The following apparatus is set out on the laboratory bench: two vacuum (thermos) flasks, two thermometers, two measuring cylinders, a beaker containing 1 M sodium hydroxide solution and a beaker containing 1 M hydrochloric acid.

Which one of the following procedures would give most accurately a value for the molar heat evolved in the neutralization of sodium hydroxide and hydrochloric acid?

A. Take the temperatures of the acid and alkali in their respective beakers, mix them into a vacuum flask and record the rise in temperature produced.
B. Mix the acid and alkali in one vacuum flask, record the temperature, transfer the contents to the second flask and record any change in temperature.
C. Allow all the acid and half the volume of alkali to come to steady recorded temperatures in the respective vacuum flasks, mix them and record the temperature rise produced.
D. Allow equal volumes of acid and alkali to come to steady recorded temperatures in the respective vacuum flasks, mix them and record the temperature rise produced.
E. With a known volume of acid in the one vacuum flask, record the temperature at regular intervals of time as alkali is added from the other flask.

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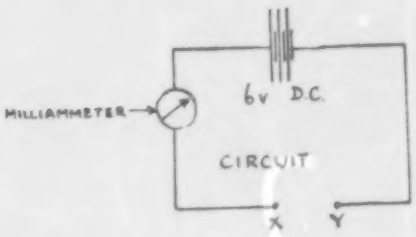
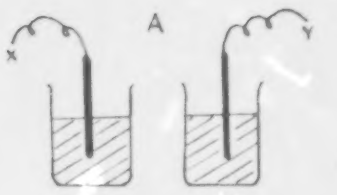
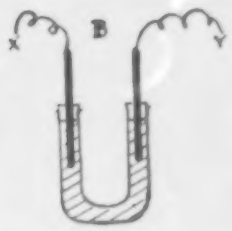
33. A number of different solutions have to be tested to find out whether or not they will each conduct electricity and, if so, what products are liberated.

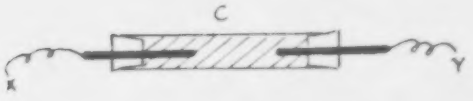
Using the circuit shown below, which of the following pieces of apparatus would be most suitable when connected between points X and Y?

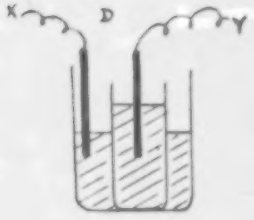
(All the beakers and tubes are made of glass, the electrodes of carbon, and solutions are shown shaded.)

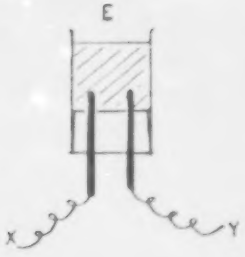






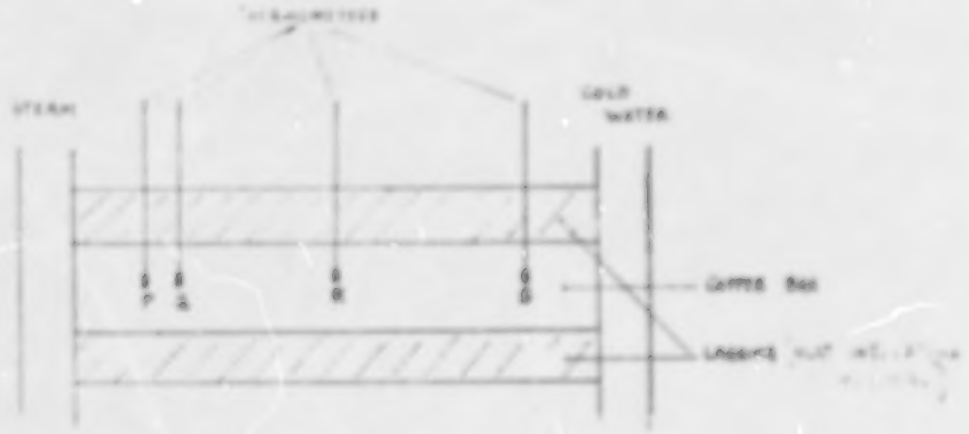






E4SA

34. One end of a well-insulated copper bar is heated and the other kept cool as shown in the figure. The temperature at different points on the bar can be read by thermometers dipping into small holes at P, Q, R and S. The distance between P and Q is 1.0 cm and the drawing is to scale.



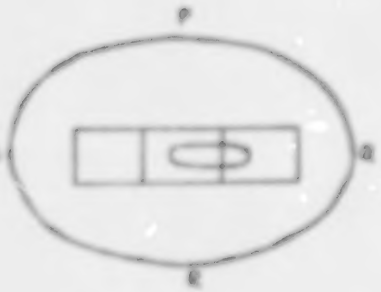
The temperature falls uniformly along the bar, and it is required to find the temperature gradient, or fall in temperature for unit length.

The two thermometers to be read for this purpose should be those placed at

A. P and Q
B. P and R
C. P and S
D. Q and R
E. R and S

35. A spirit level is placed on the top of a table and viewed from above when it appears as shown in the diagram. Which of the points P, Q, R and S should be raised as a first step towards making the table level?

A. P
B. Q
C. R
D. S
E. any of the above



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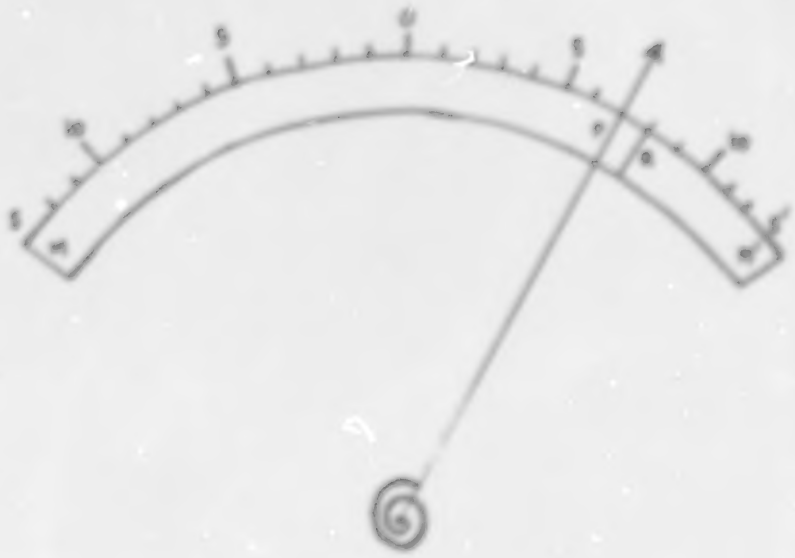
54. A meter has a pointer P which moves over a strip mirror MM' and a scale SS'. When photographed at an angle the meter appears as shown, where R is the reflection of the pointer in the mirror.

What is the correct meter reading?

A. Between 6 and 7 units
B. 7 units
C. Between 7 and 8 units
D. 8 units
E. Between 8 and 9 units



END OF BOOKLET 10

IEA FIX-SUBJECT SURVEY INSTRUMENTS

The basic procedures to be followed in the field testing of the IEA Fix-Subject Survey were set out in a series of manuals:

Stage 2 IEA/NC Manual for National Centers
IEA/SC Manual for School Coordinators
IEA/TA Manual for Test Administrators

Stage 3 IEA/NC/Stage 3 Manual for National Centers
IEA/SC/Stage 3 Manual for School Coordinators
IEA/TA/Stage 3 Manual for Test Administrators

These manuals are available from ERIC Clearinghouse.

The following extracts from these manuals have been appended to this particular IEA instrument to provide researchers with the minimum necessary test instruction information (e.g., such things as the instructions on the practice items and the warnings concerning the amount of time left for the test have been omitted here). For full details, please consult the appropriate manuals.

The Data Bank Instrument Number which appears below is a new number, assigned since the instruments were administered for the purpose of easily linking items in the instruments with the resultant variables in the Data Bank bridings. Each such variable is named in the codebook using the new instrument number and (usually) the number of the item within the instrument from which the variable is derived. The key to the new instrument numbers is as follows:

1: Type of Instrument

E = Examination (student)
Q = Questionnaire (student)
T = Teacher questionnaire
S = School questionnaire

2: Student Population

1 = I
2 = II
3 = III
4 = IV
5 = I and II
6 = II and IV
7 = I, II and IV
8 = I and IV
0 = IV Specialist
9 = QA: Teacher or School questionnaire

3: Subject

S = Science
R = Reading Comprehension
L = Literature
M = Mother Tongue (Reading Comprehension and Literature)
E = English as a Foreign Language
F = French as a Foreign Language
C = Civic Education
7 = All Stage 2 Subjects
3 = All Stage 3 Subjects
0 = All Stage 2 and Stage 3 Subjects

4-5: Instrument Within Type

One or two characters used when necessary to uniquely identify each instrument when there is more than one instrument of the same type.

Instrument Name [illegible]

Data Bank Instrument Number [illegible]

Note that via separate booklets were prepared. The first 25 items in each were those found in Instrument 9528, and items 26-50 were those found in Instrument 9529. 9530, 9531, 9532, 9533, respectively.

[illegible]
Exp IV, p. 3-6

"Take out Booklet 11 from your envelope. Also, [illegible] envelope of answer cards you remove the yellow [illegible] on the front of booklet 11 is a letter. It will be either a "P", a "Q", an "R", an "S", a "T" or a "U". Also on your [illegible] a column of letters and numbers at the top right [illegible] by the large number 3. The last of these will also be a "P", a "Q", an "R", an "S", a "T" or a "U". Make sure this letter in the [illegible] as the one on your test booklet."

[The test administrator should hold up a copy of [illegible] and answer card 3 and show where they should match.]

"Note in the bottom [illegible] should match [illegible] on the front of the test [illegible].

[illegible]

[illegible]

1. Een scheur tot perforatiebreedte in [illegible] [illegible]

   a. [illegible]
   b. [illegible]
   c. [illegible]
   d. [illegible]
   e. [illegible]
   f. [illegible]

2. Een kruipen tussen [illegible] [illegible] [illegible]

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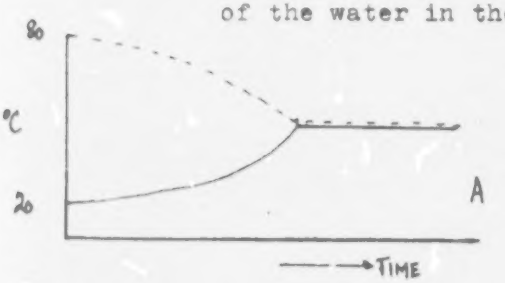
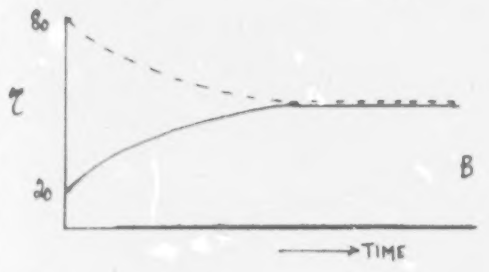
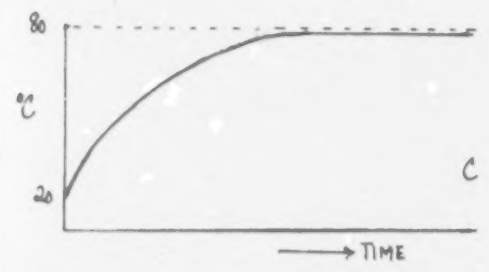
20. A stone is thrown upward at an angle of 45°. At the highest point reached by the stone its

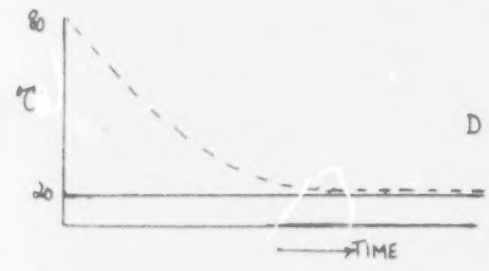
A. acceleration is zero.
B. acceleration is at a minimum, but not zero.
C. total energy is at a maximum.
D. potential energy is at a minimum.
E. kinetic energy is at a minimum.

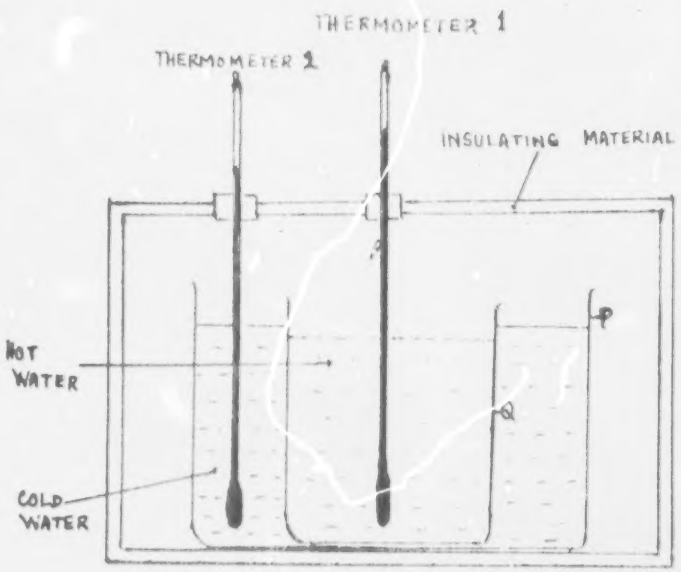
21. Using the apparatus shown in the figure below, 100g of water at 20° C was poured into the outer container P and its temperature read at intervals from thermometer 2. At the same time 100g of water at 80° C was poured into the inner container Q and its temperature read at intervals from thermometer 1. Which of the following graphs best represents the changes in the temperatures of the water in the two containers.











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22. A one-ton truck coasts from rest down an incline of a vertical height of 30 metres and is braked to a stop at the bottom. Air friction is negligible. In order to estimate the quantity of heat produced by the brakes what additional information is required?

A. The length of the incline.
B. The length and slope (gradient) of the incline.
C. The rise in temperature of the brake surfaces.
D. The average speed of the truck.
E. None of the information in statements A to D is required.

23. A man standing outdoors in the cold sounds an instrument at pitch C. Another man, standing in a warm room, hears the sound. What will be the pitch of the note heard by the man in the room.

A. The note will seem higher in pitch than C.
B. The note will seem lower in pitch than C.
C. The note will sound in the pitch of C.
D. Any of the above, depending on the difference in temperature.
E. Any of the above, depending on the amplitude of the sound.

24. By which one of the following methods can geological time be measured most accurately?

A. Size of fossils.
B. Thicknesses of the layers of sedimentary rocks.
C. Proportion of uranium isotopes in certain rocks.
D. Rate of salt accumulation in the ocean.
E. Temperatures in the mantle of the earth.

National Centers : Set P or Q or R or S or T or U to be entered here.

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IEA SIX-SUBJECT SURVEY INSTRUMENTS

The basic procedures to be followed in the main testing of the IEA Six-Subject Survey were set out in a series of manuals:

Stage 2 IEA/M1 Manual for National Centers
IEA/M2 Manual for School Coordinators
IEA/M3 Manual for Test Administrators

Stage 3 IEA/M1/Stage 3 Manual for National Centers
IEA/M2/Stage 3 Manual for School Coordinators
IEA/M3/Stage 3 Manual for Test Administrators

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

These manuals are available from ERIC Clearinghouse.

The following extracts from these manuals have been appended to this particular IEA instrument to provide researchers with the minimum necessary test instruction information (e.g., such things as the instructions on the practice items and the warnings concerning the amount of time left for the test have been omitted here). For full details, please consult the appropriate manuals.

The Data Bank Instrument Number which appears below is a new number, assigned since the instruments were administered for the purpose of easily linking items in the instruments with the resultant variables in the Data Bank holdings. Each such variable is named in the codebook using the new instrument number and (usually) the number of the item within the instrument from which the variable is derived. The key to the new instrument numbers is as follows:

1: Type of Instrument

E = Examination (student)
Q = Questionnaire (student)
T = Teacher questionnaire
S = School questionnaire

2: Student Population

1 = I
2 = II
3 = III
4 = IV
5 = I and II
6 = II and IV
7 = I, II and IV
8 = I and IV
S = IV Specialist
N = NA: Teacher or School questionnaire

3: Subject

S = Science
R = Reading Comprehension
L = Literature
M = Mother Tongue (Reading Comprehension and Literature)
E = English as a Foreign Language
F = French as a Foreign Language
C = Civic Education
2 = All Stage 2 Subjects
3 = All Stage 3 Subjects
5 = All Stage 2 and Stage 3 Subjects

4-5: Instrument Within Type

One or two characters used when necessary to uniquely identify each instrument when there is more than one instrument of the same type.

Instrument Name Advanced Science, Rotating items, Set P

Data Bank Instrument Number E4SP

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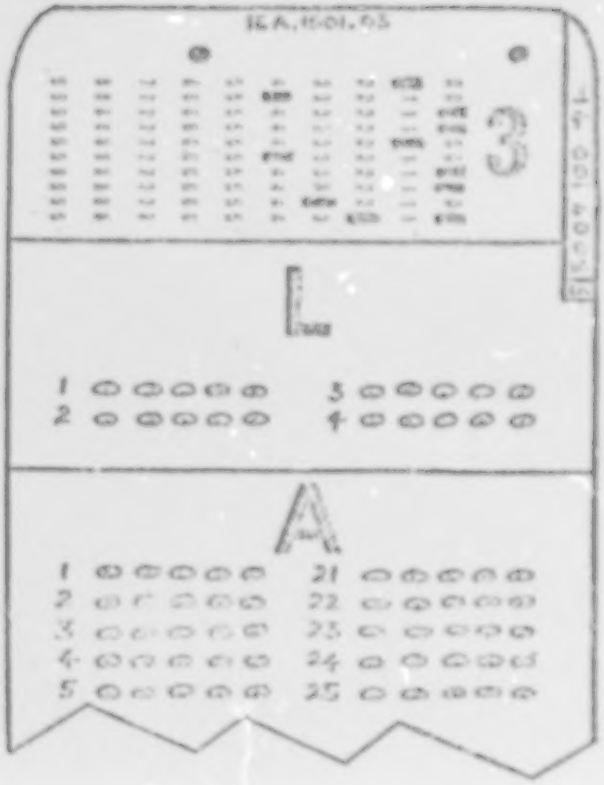
Note that six separate booklets were prepared. The first 24 items in each were those found in instrument E-3B, and items 25-30 were those found in instrument E4CT, E4CU, E4CR, E4CS, E4CT, or E4CV, respectively.

IEA/M3
Pop IV, p. 5-6

"Take out Booklet 11 from your envelope. Also, take out the small envelope of answer cards and remove the yellow answer card No. 3. On the front of Booklet 11 is a letter. It will be either a "P", a "Q", an "R", an "S", a "T" or a "U". Also on your answer card there is a column of letters and numbers at the top right hand edge by the large number 3. The last of these will also be a "P", a "Q", an "R", an "S", a "T" or a "U". Make sure this letter is the same as the one on your test booklet."
(The test administrator should hold up a copy of Booklet 11 and answer card 3 and show where they should match.)



This is the letter that should match the letter on the front of the test booklet.

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3KA/RI } continued
Pag IV, p. 5-6)

If any student finds that the answer card does not match the test, then the test administrator should correct the discrepancy by giving him a booklet which matches the letter on his answer card. The student should not be allowed to exchange answer cards.

Then say:-
"We are now ready to begin Section B. The answers to questions in this section are to be marked in part B on the answer card. Find part B on your answer card."
Indicate Section B on the answer card. Then say:
"You will have sixty minutes for Section B of the test. Remember do not waste time if you cannot answer a question, but leave it and go on to the next. Are there any questions?"

SCIENCE - TEST 118 Set F

16. What fills the space between the cell wall and the protoplast when a plant cell is plasmolysed with a salt solution?

A. Water.
B. Air.
C. Salt solution.
D. Protoplasm.
E. Cell sap.

17. In order to obtain two crops in one growing season a farmer planted some seeds which he had harvested the previous week, but the seeds failed to germinate. What can be concluded from this observation?

A. The farmer did not provide the right conditions for germination.
B. The seeds needed a longer period of maturation.
C. The farmer had not removed inhibiting substances.
D. The seeds required a period of low temperature.
E. The data are inadequate for a conclusion to be reached.

18. What is the change in oxidation number (oxidation state : valency) of manganese in the reaction represented by the equation

$$MnO_2 + 4\,HCl \longrightarrow MnCl_2 + Cl_2 + 2\,H_2O$$

A. 2.
B. 3.
C. 4.
D. 5.
E. 6.

19. Selenium is the element below sulphur in the periodic table. One would expect selenium to

A. be a metal with a high boiling point.
B. form a potassium oxy-salt of formula K_2SeO_4.
C. burn in air to form an oxide SeO_2.
D. dissolve in nitric acid to form a salt $Se(NO_3)_2$.
E. form a compound H_2Se which is weakly acidic in aqueous solution.

Assuming that the friction between the ball and the rail, the rotation of the ball and the air resistance are all negligible, which one of the alternatives is correct?

A. The ball moved as shown in the portion 1 in the figure moving off from the circular path going the direction.
B. As there is not any resistance, it reaches the same height as the point E, but then after points upward in direction.
C. As the mechanical energy of the ball changed owing to contact with the rail, it did not reach points the same height as the point E.
D. As the direction of the ball going off from the point E is inclined to the vertical, it moved a as shown in the route 1 in the figure.
E. As the mechanical energy is conserved, it moved as the route 3 in the figure.

Sound waves 1 m. in length are carried to a man's ear by two rubber tubes. With which of the following arrangements of tube-lengths will the man hear no sound?

Use this digital survey instrument

Use basic procedures for the following to view basic readings of the ECG distributions digitally which will be a version of measures.

Stages 1 [illegible] Observe this instrument [illegible]
[illegible] Observe the [illegible] [illegible]
[illegible] Observe the [illegible] [illegible]

Stages 2 [illegible] Stage 1 Observe [illegible]
[illegible] Stage 1 Observe the [illegible] [illegible]
[illegible] Stage 1 Observe the [illegible] [illegible]

Please observe and evaluate these ECG [illegible]

The following scenario does [illegible] apply to this particular [illegible] scenario in which [illegible] [illegible] [illegible]

Mix it the bonus that should count the bonus as the front of the true bottles.

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IEA/M3) continued
Pop IV, p. 5-6)

If any student finds that the answer card does not match the test, then the test administrator should correct the discrepancy by giving him a booklet which matches the letter on his answer card. The student should not be allowed to change answer cards.

Then say:-
"We are now ready to begin Section B. The answers to questions in this section are to be marked in part B on the answer card. Find part B on your answer card."
Indicate Section B on the answer card. Then say:-
"You will have sixty minutes for Section B of the test. Remember do not waste time if you cannot answer a question, but leave it and go on to the next. Are there any questions?"

SCIENCE - TEST 11B Set B

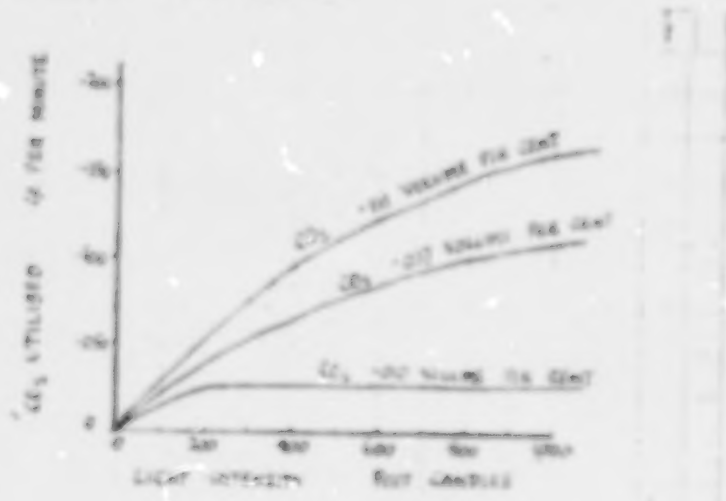
25. What is the minimum weight of NaCl that is needed to prepare 7.1 *g* of chlorine? (Approximate atomic weights: Na= 23, Cl= 35.5).

A. 5.9 *g*.
B. 7.1 *g*.
C. 11.7 *g*.
D. 12.7 *g*.
E. 14.2 *g*.

26. On the basis of the periodic table, which of the following would be described best as an oxide which is only basic?

A. Al_2O_3.
B. CO.
C. P_2O_5.
D. NO_2.
E. CaO.

27. The graph shows the relationships between the carbon-dioxide (CO_2) utilisation by wheat plants, the carbon-dioxide concentration (volume per cent) in the outside air and the light intensity (foot candles) respectively.



It has been stated that the data shown by the graph indicate that one of the factors which limit carbon-dioxide utilisation under the range of conditions covered by the graph is the concentration of carbon-dioxide present in the air. Which of the following is correct?

A. The statement is true according to the graph.
B. The statement is false according to the graph.
C. The statement cannot be judged by the graph but is in accord with an established biological principle.
D. The statement cannot be judged by the graph and is not in accord with an established biological principle.
E. The statement cannot be judged by the graph or by an established biological principle.

11. [illegible] an electric motor so that it can be used to control a remotely operated model crane. The motor provides the torque to raise the motor in which it is mounted. The motor reverses its direction of rotation when the power supply terminals are reversed.

    The motor current will be produced in the coil(s) that rotate(s) in the magnetic field.

    A. of the direction of rotation.
    B. of the current.
    C. of the magnetic field that could be set up.
    D. by the commutator and slip rings, some energy would always be transformed into heat.

12. In slightly diluted sea water, the small snails with which swells when deprived of oxygen and shrinks again when oxygen is supplied. Which is the most likely explanation?

    A. Lack of oxygen results in an incomplete oxidation of waste products.
    B. The lack of oxygen increases water absorption.
    C. Excess water is poisonous to the organism.
    D. When less oxygen is available, there is not enough energy to oppose osmotic entry of water.
    E. An increase of surface area gives a better means of oxygen absorption.

13. A ray of blue light passes through a stack of three parallel-sided blocks made of different materials. The path of the rays is shown. In which of the three blocks is the velocity of blue light greatest?

    A. X.
    B. Y.
    C. Z.
    D. The velocity is the same in all the blocks.
    E. The information given is insufficient to be able to say.

The basic procedures to be followed in the data testing of the IEA Six-Subject Survey were set out in a series of manuals:

Stage 2 IEA/NC Manual for National Centers
IEA/SC Manual for School Coordinators
IEA/TA Manual for Test Administrators

Stage 3 IEA/NC/Stage 3 Manual for National Centers
IEA/SC/Stage 3 Manual for School Coordinators
IEA/TA/Stage 3 Manual for Test Administrators

These manuals are available from SWIS (Stockholm).

The following extracts from these manuals have been extracted to this particular IEA instrument to provide researchers with the minimum necessary test instruction information (e.g., such things as the instructions on the practice items and the warnings concerning the amount of time left for the test have been omitted here). For full details, please consult the appropriate manuals.

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8 = I and IV
X = IV Specialist
9 = NA: Teacher or School questionnaire

3: Subject

S = Science
R = Reading Comprehension
L = Literature
M = Mother Tongue (Reading Comprehension and Literature)
E = English as a Foreign Language
F = French as a Foreign Language
C = Civic Education
Z = All Stage 2 Subjects
Y = All Stage 3 Subjects
X = All Stage 2 and Stage 3 Subjects

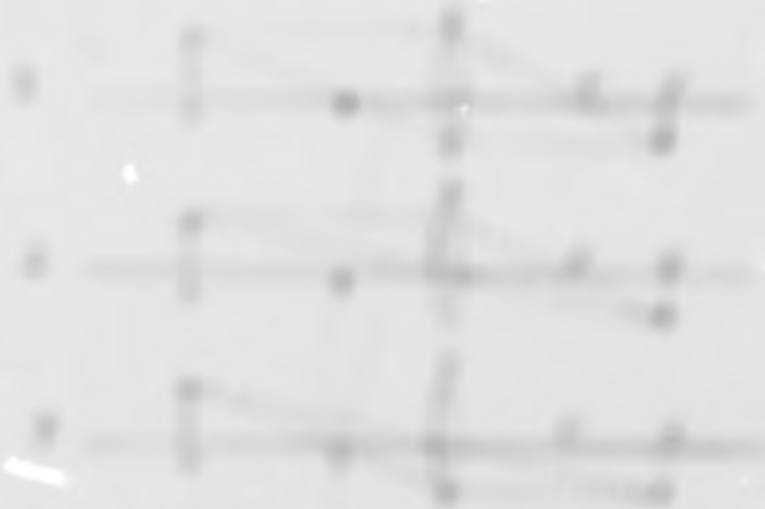
4-5: Instrument Within Type

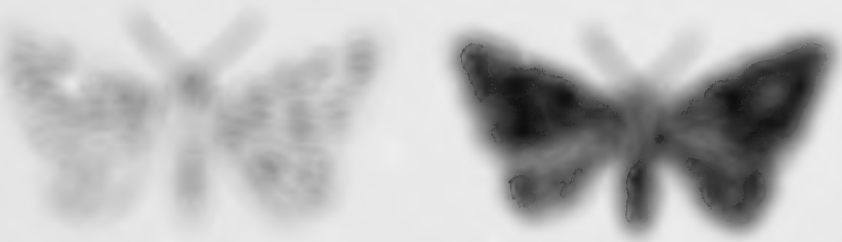
One or two characters used when necessary to uniquely identify each instrument when there is more than one instrument of the same type.

Instrument Name Integrated Science, Stapling Items, Int 2

Data Bank Instrument Number ESI2

3
L
A





IEA/M3) continued
Pop IV, p. 5-6)

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If any student finds that the answer card does not match the test, then the test administrator should correct the discrepancy by giving him a booklet which matches the letter on his answer card. The student should not be allowed to change answer cards.

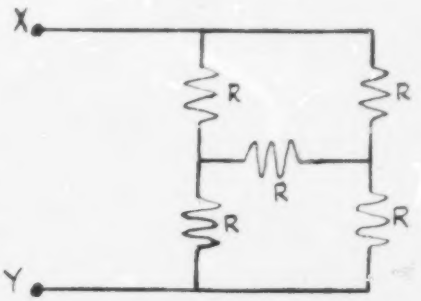
Then say:-
"We are now ready to begin Section B. The answers to questions in this section are to be marked in part B on the answer card. Find part B on your answer card."
Indicate Section B on the answer card. Then say:-
"You will have sixty minutes for Section B of the test. Remember do not waste time if you cannot answer a question, but leave it and go on to the next. Are there any questions?"

SCIENCE - TEST 11B Set T

BEST COPY AVAILABLE

25. Each resistor in the diagram has the same resistance R. What resistance will be measured between terminals X and Y?

A. 2R.
B. $\frac{4R}{3}$.
C. R.
D. $\frac{R}{2}$.
E. $\frac{R}{3}$.



26. A jar of oxygen gas and a jar of hydrogen gas are at the same temperature. The molecules of the two gases have on average the same

A. velocity.
B. momentum.
C. force.
D. potential energy.
E. translational kinetic energy.

27. The rate of reaction of two substances X and Y is measured at several concentrations of X and Y as shown in the table.

Rate of reaction millimoles/litre second	12	36	24
Concentration of X moles/litre	5	15	10
Concentration of Y moles/litre	5	5	10

The rate of reaction is

A. proportional to the concentration of X but independent of the concentration of Y.
B. proportional to the concentration of X and Y.
C. proportional to the concentration of Y but independent of the concentration of X.
D. dependent on the concentrations of X and Y but not satisfactorily expressed in A, B or C.
E. dependent on some unspecified factors other than concentration.

BEST COPY AVAILABLE

20. Which of the following best describes the egg cell in the embryo sac of a plant?

A. It is formed by mitosis.
B. It gives rise to the endosperm.
C. It is analogous to a pollen grain.
D. It is a zygote.
E. It is a female gamete.

21. Which one of the following formulae represents a substance which you would NOT expect to exist under normal laboratory conditions?

A. NaH.
B. H_2S.
C. SiO_2.
D. $AlCl_2$.
E. O_3.

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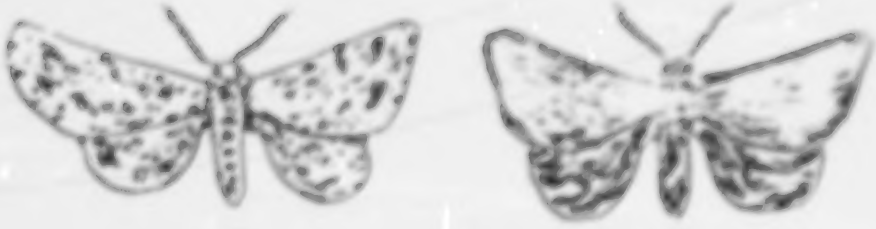
E4ST

30. X and Y represent two forms of the same moth, a light speckled form and a predominantly dark, or melanic, form.



X Y

During the 19th century the air in some parts of England became increasingly polluted with soot through the growth of industry based on the buring of coal. One effect of this pollution was that lichens would no longer grow on the trunks and branches of trees as these became blackened with soot.

Until 1850 the only form of this moth that had been recorded was the light form X. Then in 1850 the dark form Y was reported from one of these industrial areas. By the end of the 19th century the dark form had become quite common and now it is, in many localities, the commoner of the two forms, especially in the vicinity of large towns, where it often comprises as much as 95% of the total population, although the light form predominates in areas away from large centres of population.

The papagraph describes a case of evolution through

A. sexual selection.
B. natural selection.
C. intra-specific competition.
D. geographical isolation.
E. the inheritance of acquired characters.

IEA SIX-SUBJECT SURVEY INSTRUMENTS

The basic procedures to be followed in the main testing of the IEA Six-Subject Survey were set out in a series of manuals:

Stage 2 IEA/NC Manual for National Centers
IEA/SC Manual for School Coordinators
IEA/TA Manual for Test Administrators

Stage 3 IEA/NC-Stage 3 Manual for National Centers
IEA/SC/Stage 3 Manual for School Coordinators
IEA/TA/Stage 3 Manual for Test Administrators

These manuals are available from ERIC Clearinghouses.

The following extracts from these manuals have been appended to this particular test instrument to provide researchers with the minimum necessary test instruction information (e.g., such things as the instructions on the practice items and the warnings concerning the amount of time left for the test have been omitted here). For full details, please consult the appropriate manuals.

The Data Bank Instrument Number which appears below is a new number, assigned since the instruments were administered for the purpose of easily linking items in the instruments with the resultant variables in the Data Bank bridges. Each such variable is coded in the codebook using the new instrument number and (usually) the number of the item within the instrument from which the variable is derived. The key to the new instrument numbers is as follows:

1: Type of Instrument

E = Examination (student)
Q = Questionnaire (student)
T = Teacher questionnaire
S = School questionnaire

2: Student Population

1 = I
2 = II
3 = III
4 = IV
5 = I and II
6 = II and IV
7 = I, II and IV
8 = I and IV
9 = IV Specialist
0 = 8A: Teacher or School questionnaire

3: Subject

S = Science
R = Reading Comprehension
L = Literature
M = Mother Tongue (Reading Comprehension and Literature)
E = English as a Foreign Language
F = French as a Foreign Language
C = Civic Education
2 = All Stage 2 Subjects
3 = All Stage 3 Subjects
5 = All Stage 2 and Stage 3 Subjects

4-5: Instrument Within Type

One or two characters used when necessary to uniquely identify each instrument when there is more than one instrument of the same type.

Instrument Name Integrated Science, Reading Items, Set 2

Data Bank Instrument Number ES72

Note that six separate booklets were prepared. The first (A Form) is such were those found in Units Four (A-D), and Units Five (A-D) were those found in Lectures Five, Six, Seven, Eight, and Nine, respectively.

IRA(M)
Pop IV, p. 3-6

"Take out booklet II from your envelope. Also, take out the small envelope of answer cards and remove the yellow answer card No. 3. On the front of booklet II is a letter. It will be either a "F", a "G", an "H", an "I", a "J" or a "K". Also on your answer card there is a column of letters and numbers at the top right hand edge by the large number 3. One pair of these will also be a "F", a "G", an "H", an "I", a "J" or a "K". Make sure this letter is the same as the one on your test booklet."

[The test administrator should hold up a copy of booklet II and answer card 3 and show where they should match.]

This is the letter that should match the letter on the front of the test booklet.

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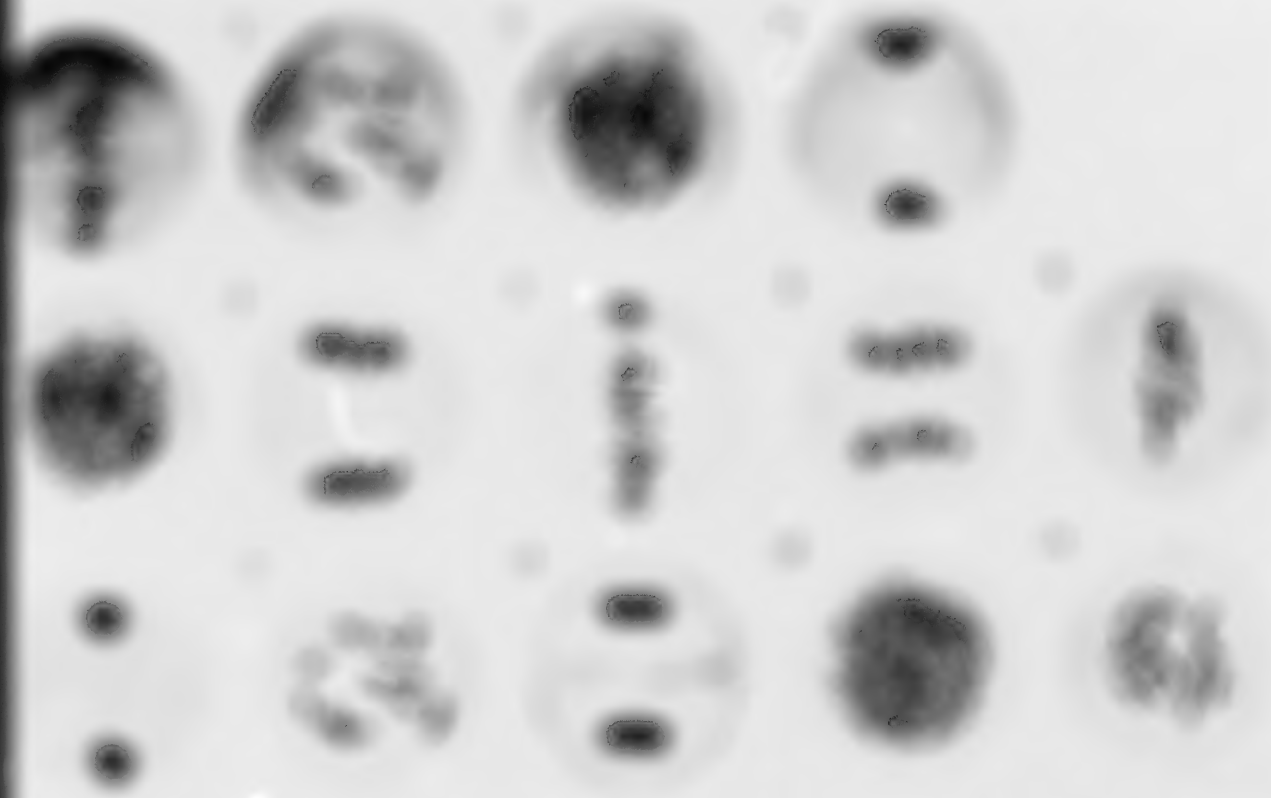

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10. What is the probable haploid number of chromosomes for this plant?

A. 24.
B. 10.
C. 12.
D. 8.
E. 20.

11. All the offspring from a hooded/hooded x white/white cross in rats are found to be hooded. If these F_1 hooded rats are mated together and produce litters totalling 50 rats, which of the following proportions is most likely?

A. 50 hooded : nil white.
B. 50 white : nil hooded.
C. 38 white : 12 hooded.
D. 24 white : 26 hooded.
E. 10 white : 40 hooded.

12. In a living plant cell chlorophyll absorbs light and as a result

A. carbon dioxide is fixed into phosphoglyceric acid.
B. carbohydrates are formed
C. ATP is converted into ADP.
D. ADP is converted into ATP and hydrogen is released from water.
E. oxygen is released from CO_2.

13. In slightly diluted sea water, the small marine worm Gunda swells when deprived of oxygen and shrinks again when oxygen is supplied. What is the most likely explanation?

A. Lack of oxygen results in an incomplete oxidation of waste products.
B. The lack of oxygen increases water absorption.
C. Excess water is poisonous to the organism.
D. When less oxygen is available, there is not enough energy to oppose osmotic entry of water.
E. An increase of surface area gives a better means of oxygen absorption.

14. Grazing beef cattle utilise only about 1/7th of the plant food they eat. The intensive rearing of animals in buildings can improve greatly on this. Which of the following factors is <u>least</u> likely to affect this?

A. Competition for food by other animals is prevented.
B. The animals receive less light.
C. There is less loss of body weight.
D. Less energy is used in movement.
E. Special additions can be made to the diet.

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15. Which of the following would be the best way of testing the hypothesis that two given enzymes affect the rate of a certain reaction?

A. Try the reaction with a mixture of the enzymes at different temperatures.
B. Purify the enzymes and then try them out on the reaction.
C. Try the enzymes separately and together on the reaction.
D. Try inhibiting one enzyme by dialysis.
E. Try mixtures of the enzymes in different proportions on the reaction.

16. Secretions of endocrine organs are not directly responsible for

A. calcium metabolism.
B. secretion by the adrenal cortex.
C. changes in the uterine lining.
D. changes of body temperature.
E. general body growth.

17. Cobalt chloride paper is blue when dry. It gradually changes colour to pink in the presence of water vapour. Three 1 cm square dry cobalt chloride papers were treated as follows:

The first was fastened to the upper surface of a leaf by means of a clip, the second to the lower surface in a similar way, and the third hung free in the air. The time taken for the papers to achieve a standard pink colour was noted. The first took 9 minutes, the second 10.5 minutes, the third 18.0 minutes.

Which of the following conclusions is justified on this evidence alone?

A. There are more stomata on the lower surface of the leaf than on the upper.
B. No water vapour is given off from the lower surface of the leaf.
C. The upper leaf surface gives off more water vapour than the lower.
D. Both leaf surfaces give off water vapour at the same rate.
E. There are no stomata on the upper surface of the leaf.

18. The maintenance of a constant body temperature in man involves a balance between production of heat and loss of heat. Which of the factors given below least affects this balance?

A. The circulation of the blood.
B. Evaporation of water from the body surfaces.
C. Muscular contraction.
D. Dilation of blood vessels in the skin.
E. The heating of cold air in the lungs.

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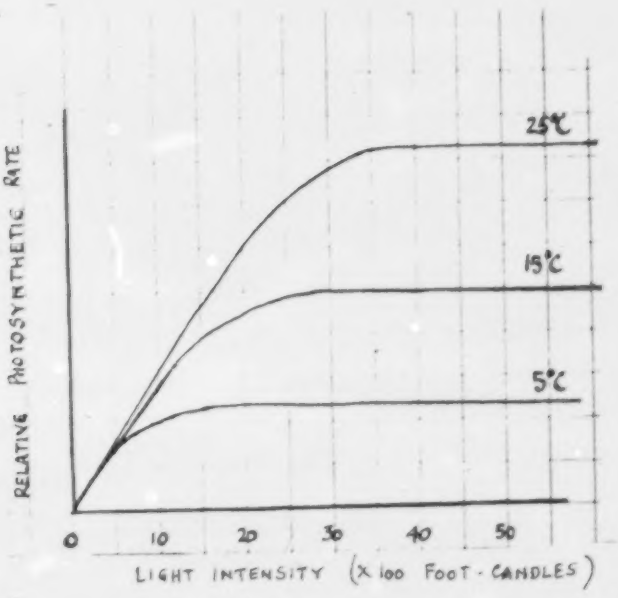
19. Lymph is forced into the tissues by

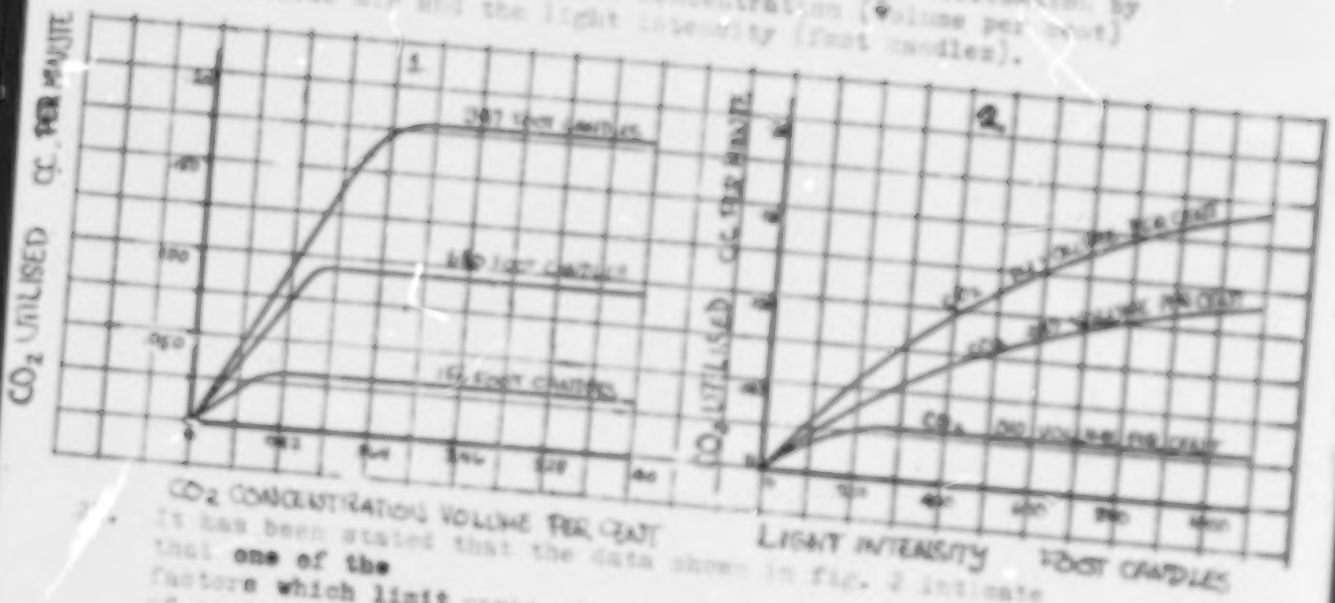
A. blood pressure.
B. the action of the liver.
C. intestinal villi.
D. the action of the kidney.
E. a diffusion gradient.

20. In an experiment with a certain plant, the photosynthetic rate per unit of leaf area was measured at different light intensities. The experiment was repeated at three different temperatures, 5°C, 15°C and 25°C. An adequate supply of carbon dioxide was maintained throughout the experiments. The graph shows the results.



On the basis of the data given in the graph, what factor or factors determine the photosynthetic rate in light intensities more than 3,000 foot-candles?

A. Light intensity.
B. Temperature.
C. Temperature and light intensity.
D. Water status of plant.
E. No factor can be ascertained from the graph.


1
2
307 foot candles
CO_2 UTILISED CC. PER MINUTE
CO_2 CONCENTRATION VOLUME PER CENT
LIGHT INTENSITY FOOT CANDLES

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23. It has also been stated that fig. 1 shows that if the amount of carbon dioxide is decreased from .12% by volume and the light intensity held constant, there is an increase in carbon dioxide utilization.
Which of the following is correct?

1. The statement is true according to the graph.
2. The statement is false according to the graph.
3. The statement cannot be judged by the graph but is in accord with an established biological principle.
4. The statement cannot be judged by the graph and is not in accord with an established biological principle.
5. The statement cannot be judged by the graph or by an established biological principle.

24. The carbon dioxide content of the layer of air next to the wheat in a cornfield on a clear warm summer day will be less than on a still warm night.
Which of the following is correct?

1. The statement is true according to the graphs.
2. The statement is false according to the graphs.
3. The statement cannot be judged completely by the graphs but is in accord with an established biological principle.
4. The statement cannot be judged completely by the graphs and is not in accord with an established biological principle.
5. The statement cannot be judged completely by the graphs or by an established biological principle.

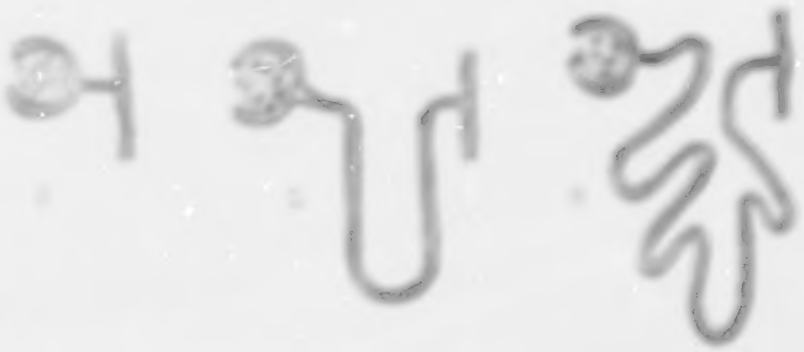
25. The carbon dioxide content of the air is approximately 0.03% by volume. The light intensity at noon on a clear summer day is in the neighbourhood of 8,000 to 10,000 foot candles. On the basis of the data given in fig. 1, will the rate of carbon dioxide utilization be limited on a very clear summer day by the carbon dioxide content of the air rather than the intensity of the light?
Which of the following answers to this question is correct?

1. Yes. The data make this quite clear.
2. No. The data show this is not true.
3. It cannot be determined from the data given, but is in accord with an established biological principle.
4. It cannot be determined from the data given and is not in accord with an established biological principle.
5. It cannot be determined from the data given or by an established biological principle.

26. Which one of the following is not controlled by hormones?

1. Water uptake in the stem.
2. Downward growth of the radicle.
3. Flowering under the influence of increasing day length.
4. Falling of the leaves of deciduous trees in autumn.
5. Orientation of stems towards lateral light.

Questions 27 and 28 refer to the following. The primary function of a kidney tubule is to reabsorb water. The diagrams show three types of kidney tubules (nephrons).



27. Which kidney tubule (nephron) is most likely to occur in a desert animal?

    A. I.
    B. II.
    C. III.
    D. It is impossible to say.
    E. It will depend upon whether the animal is a herbivore or a carnivore.

28. Which kidney tubule (nephron) is most likely to occur in fresh-water animals?

    A. I.
    B. II.
    C. III.
    D. It is impossible to say.
    E. It will depend upon whether the animal is cold-blooded or warm-blooded.

29. Which of the following best describes the egg cell in the ovule sac of a plant?

    A. It is formed by mitosis.
    B. It gives rise to the endosperm.
    C. It is analogous to a pollen grain.
    D. It is a zygote.
    E. It is a female gamete.

56. The diagrams show the external appearance at various stages of two kinds of animals. What two kinds are they?

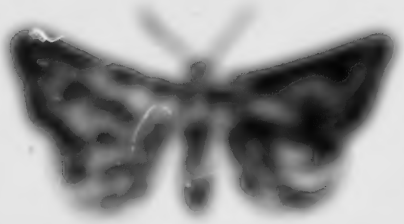
a. reptile and reptile.
b. Echinoderm and mammal.
c. Fish and mammal.
d. Coelenterates and birds.
e. Insects and birds.

57. In order to obtain two crops in one growing season a farmer planted some seeds which he had harvested the previous year but the seeds failed to germinate. What can be considered from this observation?

a. The farmer did not provide the right conditions for germination.
b. The seeds needed a longer period of dormancy.
c. The farmer had not removed poisoning substances.
d. The seeds required a period of low temperature.
e. The rains are inadequate for a succession to be required.

58. Some organisms are difficult to classify as plants or animals because they are

a. Saprophytes.
b. capable of acting as both predators and consumers.
c. photosynthetic and thus can difficult to study.
d. able to build up complex foods by making use of light energy.
e. producers.



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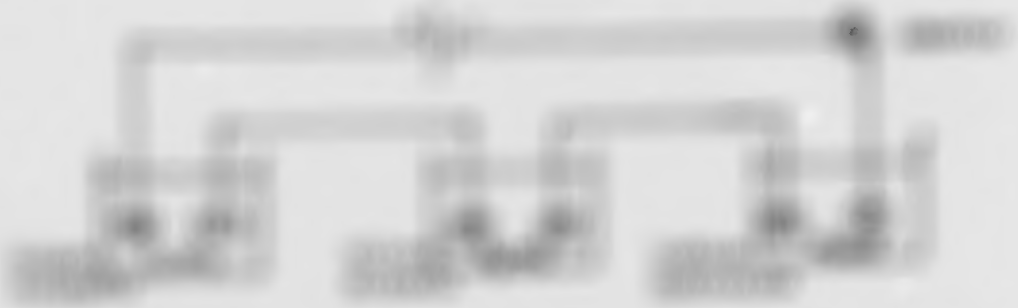

9. In the periodic table group beginning with nitrogen, which one of the following changes can be noted as the elements are considered in the order of their increasing atomic weight?

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A. The elements become more metallic.
B. The elements become less metallic and the heaviest element in the group is non-metallic.
C. The elements have about the same metallic properties.
D. The elements show no trend in their metallic properties, which vary periodically and not by groups.
E. The elements show no trend in their metallic properties because the periodic table gives no guide to metallic and non-metallic properties.

10. If an atom of a radioactive element first emits an alpha particle and then emits a beta particle, the nuclear charge will

A. decrease by 1 unit.
B. increase by 1 unit.
C. decrease by 2 units.
D. decrease by 3 units.
E. decrease by 4 units.

11. The word "covalent" is correctly used to describe all the strong bonds between the atoms in

A. magnesium oxide.
B. copper sulphate.
C. sodium chloride.
D. carbon disulphide.
E. nickel.

12. The presence of ions in an aqueous (water) solution of a substance is most directly detected by

A. finding out if it conducts electricity.
B. measuring the density of the solution and comparing it with those of the pure solute and water.
C. seeing if the solution has an electric charge.
D. evaporating the solution and testing the residue for conductivity.
E. adding an ionic substance and seeing if there is a reaction.

13. Which of the following series of numbers represents the electronic structure of an element with a variable valency (oxidation state)?

A. 2, 8, 7.
B. 2, 8, 15, 2.
C. 2, 8, 18, 2.
D. 2, 8, 8, 1.
E. 2, 8, 18, 7.

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Questions 14 and 15 refer to a portion of the periodic table

I	III	VII	VIII
T	U	V	W
		X	

Hypothetical elements T, U, V, W and X are located in the upper half of the periodic table of elements shown above. Elements T, U, V and W are all in the same period, with element T a member of group I, element U a member of group III, element V a member of group VII and element W the last element in the period. Element X is in the same group as element V and is immediately below it.

14. Which of the following comparisons of elements T and V is correct?

A. V is more electronegative than T.
B. V is more metallic than T.
C. Atoms of V have fewer valence electrons than do those of T.
D. Atoms of V have fewer electrons than do those of T.
E. The usual valence (combining capacity) of V is greater than that of T.

15. Which of the following comparisons of elements V and X is correct?

A. Atoms of V have fewer valence electrons than atoms of X.
B. Atoms of V are smaller than those of X.
C. V is more metallic than X.
D. V is much less reactive than X.
E. V has a much higher melting point than X.

16. The boiling point of sodium chloride (formula weight 58.5) is 1413°C whereas the boiling point of carbon tetrachloride (formula weight 154) is 77°C. On considering the formula weights it might be expected that carbon tetrachloride would have the higher boiling point. The reason for the observed result is that sodium chloride is

A. a solid and carbon tetrachloride is a liquid.
B. ionic and carbon tetrachloride is covalent.
C. an inorganic substance whereas carbon tetrachloride is an organic substance.
D. soluble in water whereas carbon tetrachloride is not.
E. based upon a cubic unit lattice but carbon tetrachloride has a tetrahedral unit structure.

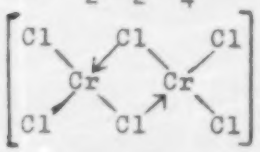
17. Chromic chloride hexahydrate has the empirical formula $CrCl_3.6H_2O$. It exists in several isomeric forms and when one of these isomers is allowed to react with excess of silver nitrate in aqueous solution 2 moles of silver chloride are precipitated for every mole of the chromium salt. The nature of this particular isomer could be represented as

A. $Cr(H_2O)_6^{3+} + 3Cl^-$.

B. $CrCl_3(H_2O)_3 + 3H_2O$.

C. $(CrCl(H_2O)_5)^{2+} + 2Cl^- + H_2O$.

D. $(CrCl_2(H_2O)_4)^+ + Cl^- + 2H_2O$.

E.  $+ 12H_2O$.

18. The half life of the radioactive isotope potassium, K^{42}, is 12.4 hours. The activity of a sample will be reduced to 3% of its original value after an estimated time of

A. 12.4 hours.
B. 37.2 hours.
C. 42 hours.
D. 63 hours.
E. 124 hours.

19. Selenium is the element below sulphur in the periodic table. One would expect selenium to

A. be a metal with a high boiling point.
B. form a potassium oxy-salt of formula K_3SeO_4.
C. burn in air to form an oxide SeO.
D. dissolve in nitric acid to form a salt $Se(NO_3)_4$.
E. form a compound H_2Se which is weakly acidic in aqueous solution.

20. Which one of the following compounds can exist in optically active forms?

A. $CH_3\overset{OH}{\overset{|}{C}}HCH_3$.

B. $CH_3.CH=CH.CH_3$.

C. $HOCH_2\text{-}\overset{OH}{\overset{|}{C}}H\text{-}CH_2OH$.

D. $CH_3.CH=CH_2$.

E. $CH_3\text{-}\overset{OH}{\overset{|}{C}}H\text{-}CH_2CH_3$.

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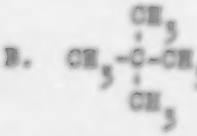
Questions 21 and 22 refer to the following.

You are given five bottles, each containing a different organic compound, together with the following information:

Bottle Label	Melting Point°C	Boiling Point°C	State at Room Temperature
(i)	-183	-89	gas
(ii)	- 2	9	gas
(iii)	-130	36	liquid
(iv)	- 78.5	136	liquid
(v)	204	290	solid

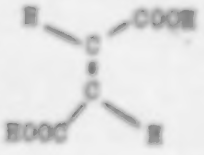
Considering the factors which influence the strength of intermolecular (van der Waals) forces, hydrogen bonding and solubility, select one of the following compounds (A to E) in answer to questions 21 and 22.

A. $CH_3-CH_2-CH_2-CH_2-CH_3$.

B. 

C. $CH_3-CH_2-CH_2-CH_2-CH_2OH$.

D. CH_3-CH_3.

E. 

21. Which of these compounds is contained in bottle (i)?

22. Which of these compounds is contained in bottle (v)?

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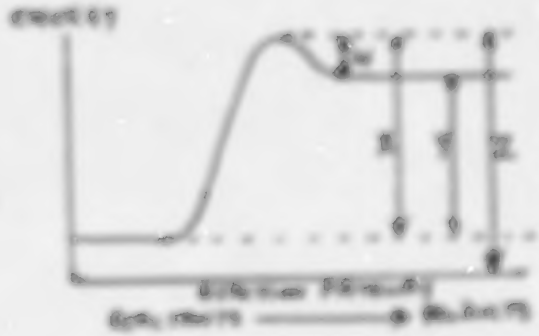
23. The electronegativity (electron attracting power) of a given element on Pauling's scale can be estimated from the electronegativities of the neighbouring elements in the periodic table. In estimating the electronegativity of chlorine from those of the elements to the left and right of it in period III, the determining factor is that, in going to the right in the period,

A. chemical reactivity decreases.
B. the number of filled energy levels per atom increases.
C. the van der Waals radius increases.
D. the density decreases.
E. the nuclear charge increases.

24. In a similar manner to that described in the previous question an electronegativity value for radium (Ra) can be obtained by using the electronegativity values of the neighbouring elements in Group II. The determining factor in this case is that in going down Group II

A. melting point increases.
B. the number of filled energy levels per atom increases.
C. atomic radius decreases.
D. nuclear radius decreases.
E. electrical conductivity decreases.

Questions 25 to 27 relate to the following potential energy diagram for the reaction $Br + X_2 \longrightarrow XBr + X$.



25. The heat of reaction is represented by

A. W.
B. X.
C. Y.
D. Z.
E. Z minus W.

26. The energy of activation for the above reaction is represented by

A. W.
B. X.
C. Y.
D. Z.
E. Z minus W.

27. The activation energy for the reverse of the reaction given above (i.e. for the reaction, $XBr + X \longrightarrow Br + X_2$) is represented by

A. W.
B. X.
C. Y.
D. Z.
E. Z plus X.

28. Which of the following represents the variation of the number of molecules of gases, n_g, having energy E in a sample of a gas at room temperature?

A. B. C.

D. E.

29. A reaction does not take place in the dark but proceeds explosively as soon as exposed to light. Which is the best explanation of this fact?

A. Light provides the energy which is released as heat in the explosion.
B. Light initiates the reaction which then proceeds very rapidly.
C. Light acts as a catalyst, being regenerated during the explosion.
D. Light heats the unstable reactant(s) which then explode.
E. The total reaction is endothermic and light initiates it by supplying more than the required energy.

30. Assuming equilibrium is reached in the reaction

$$2H + I_2 \rightleftharpoons 2HI_g \qquad \Delta E = -13\ kcal$$ (The reaction to the right is exothermic.)

a greater yield of HI_g will be obtained by

A. raising the temperature and pressure.
B. lowering the temperature and pressure.
C. raising the temperature and lowering the pressure.
D. lowering the temperature and raising the pressure.
E. adding a catalyst and raising the pressure.

[illegible]

21. Many a small town of East Anglesia was gutted by a conservational accident of hydrogen peroxide. The accident became but most practically acquired attention. In this process large amounts of oxygen were given off. Which of the following is the best explanation?

a. The great amount of heat in the by the release of oxygen
b. The addition of heat accelerated the reaction to increase
c. The addition of hydrogen by heat accelerated but subtracted by a rise in temperature.
d. The addition of air accelerated by heat accelerated but by accelerated by a rise in temperature.
e. The addition of substance by a rise in temperature but decreased the products.
f. The addition of hydrogen by heat accelerated but accelerated by a rise in temperature.

22. The rate of reaction of two substances X and Y is measured as moles consumed/minute of X and Y as shown in the table.

Rate of reaction milliseconds/litre moles	10	30	70
Concentration of X moles/litre	5	10	20
Concentration of Y moles/litre	5	5	10

The rate of reaction is

a. proportional to the concentration of X but independent of the concentration of Y.
b. proportional to the concentration of X and Y.
c. proportional to the concentration of X but independent of the concentration of Y.
d. dependent on the concentration of X and Y but not multiplicatively dependent on X, Y or Y.
e. dependent on some unspecified function other than concentration.

23. Elements in periodic from Sandra to

a. heating Sandra to a plastic state of ash.
b. reducing Sandra into ores to a fineness.
c. reducing Sandra into ashes gas to a fineness.
d. crystallizing Sandra dissolved in sulphuric acid.
e. crystallizing Sandra dissolved in water vapour.

24. Which of the following elements is most likely to exist for highest oxidation state of a tetravalent metal when combined with it?

a. Iodine.
b. Fluorine.
c. Platinum.
d. Manganese.
e. Hydrogen.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

(b) [illegible]

[illegible]

[illegible]

(i) [illegible]

(ii) [illegible]

(iii) [illegible]

(iv) [illegible]

(v) [illegible]

(c) [illegible]

(i) [illegible]

(ii) [illegible]

(iii) [illegible]

[illegible]

(a) $[illegible]$

(b) $[illegible]$

(c) $[illegible]$

$[illegible]$

(d) $[illegible]$

(e) $[illegible]$

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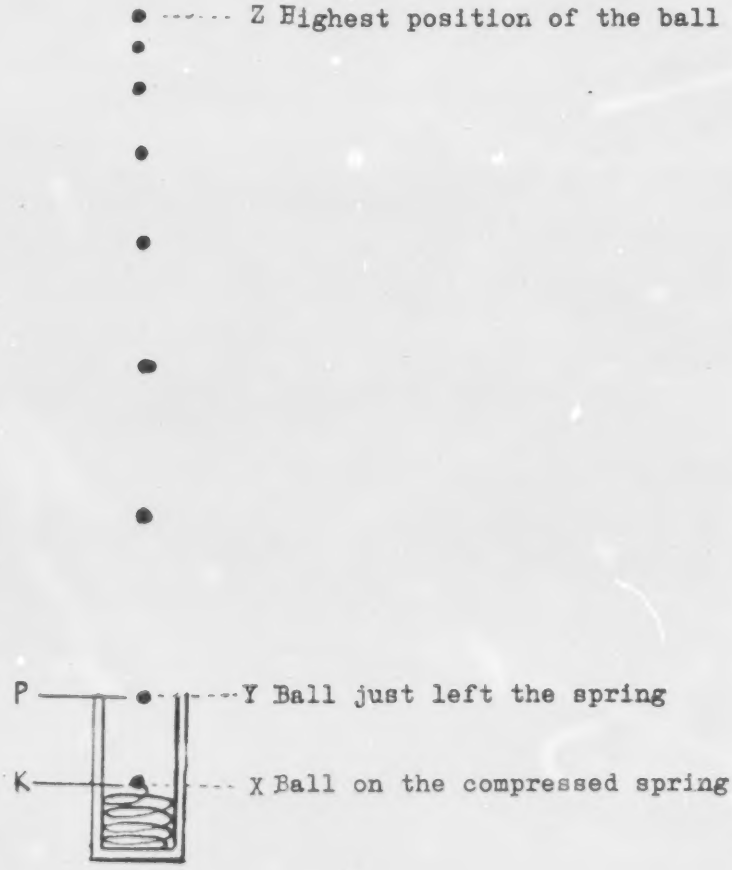
5. The figure shows the respective positions which a small ball occupied every 1/7 second after it had been shot up vertically by a spring. Assume that the spring is compressed to the point K and then released, and that the ball leaves the spring at P. Z is the highest position that the ball reaches. Assume air resistance to be negligible.

Assuming that the acceleration due to gravity is 9.8 m/s^2, what is the acceleration of the ball at the position Y?

A. Zero.
B. Less than 9.8 m/s^2.
C. 9.8 m/s^2.
D. Greater than 9.8 m/s^2
E. It is impossible to say unless the height the ball rises is given.



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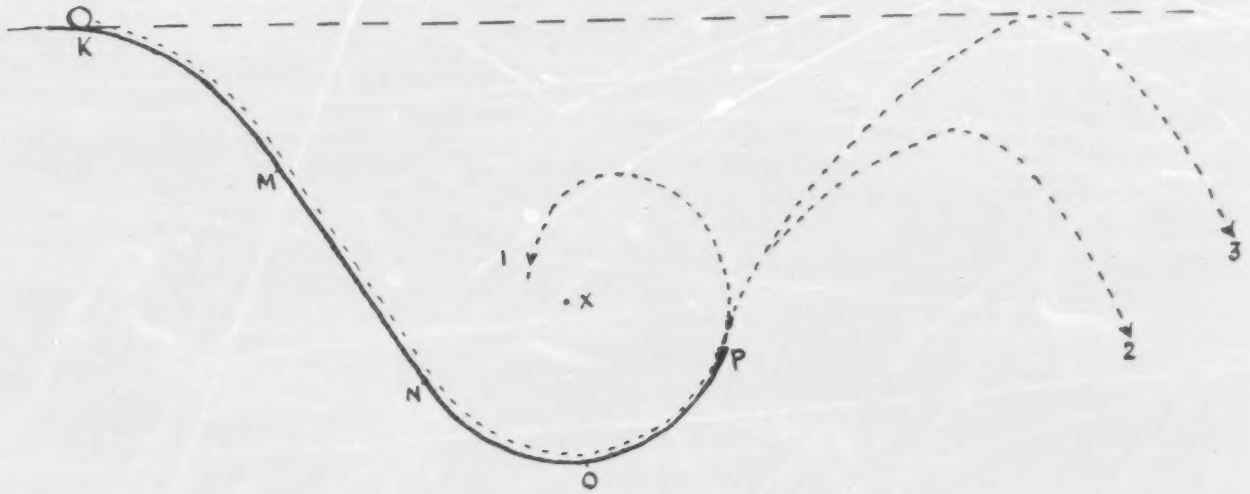
6. A ball was released at the position K on the rail shown in the figure. On the rail the part MN is a straight line, and the part N O P is a circular arc with its centre at X. The ball moved along the rail and then went off from the rail at the position P, which is lower than X.



Assuming that the friction between the ball and the rail, the rotation of the ball and the air resistance are all negligible, which one of the alternatives is correct?

A. The ball moved as shown in the curve 1 in the figure running off from the circular path owing to the gravitation.
B. As there is not any resistance, it reached the same height as the point K, but the actual path cannot be determined.
C. As the mechanical energy of the ball changed owing to contact with the rail, it did not reach quite the same height as the point K.
D. As the direction of the ball going off from the point P is inclined to the vertical, it moved as shown in the curve 2 in the figure.
E. As the mechanical energy is conserved, it moved as the curve 3 in the figure.

7. A 5 kg ball moving at 20 m/s collides with a ball of unknown mass moving at 10 m/s in the same direction. After collision, the 5 kg ball moves at 10 m/s and the other ball at 15 m/s, both still in the same direction.

The mass of the second ball is

A. 2 kg.
B. 6 kg.
C. 10 kg.
D. 12 kg.
E. 30 kg.

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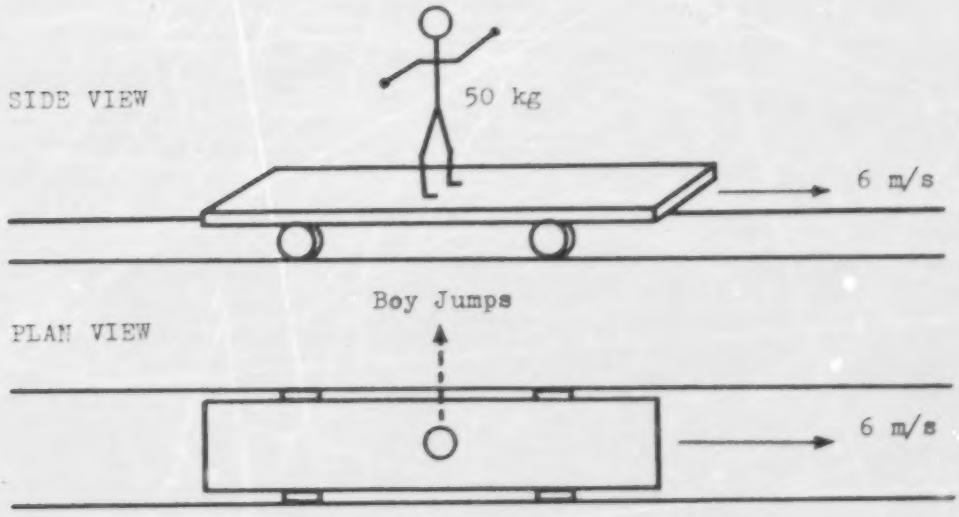
8. A 50 kg boy stands on a trolley of mass 100 kg. The trolley is travelling to the right on rails at a constant speed of 6 m/s.



After the boy jumps sideways off the trolley pushing off at right angles to it, the speed of the trolley is about

A. 3 m/s.
B. 4 m/s.
C. 6 m/s.
D. 9 m/s.
E. 12 m/s.

9. Water at a depth of 4.0 m in a constant-head reservoir flows with friction through a horizontal tube and issues from the open end with a speed of 6.0 m/s. About what fraction of the mechanical energy of the water is lost in friction?

A. Zero.
B. 0.33.
C. 0.45.
D. 0.55.
E. 0.67.

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11. If, in an imaginary situation, a 1 kg block of ice at 0°C is dropped from such a height that all of it is melted by the heat generated on impact with the ground, from what height would a 25 kg block of ice have to be dropped to melt completely, assuming that in both cases all of the heat is absorbed by the ice?

A. 25 times as high.
B. 5 times as high.
C. 1/5 as high.
D. 1/25 as high.
E. The same height.

12. A boat loaded with rocks floats in a small swimming pool. If the rocks are thrown overboard into the water, the level of the water in the pool

A. rises.
B. remains the same.
C. falls.
D. the result depends on the density of the boat.
E. the result depends on the relative densities of the rocks and the material of the boat.

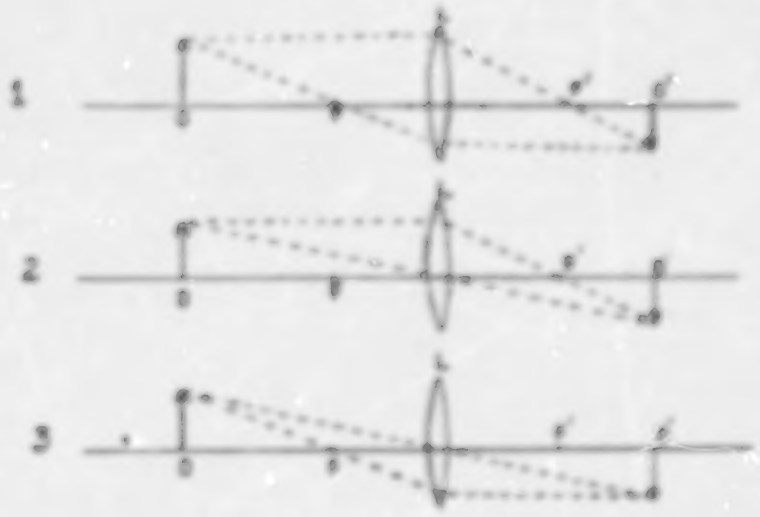
13. 2 g of hydrogen are in a rigid container exerting a pressure P on the walls. 2 g of another gas are introduced, temperature remaining constant. The pressure in the container, assuming no chemical reaction occurs, is now

A. between P and 2P.
B. 2P.
C. greater than 2P.
D. still P.
E. smaller or greater than P depending on the deviation of the mixture from the ideal.

14. A jar of oxygen gas and a jar of hydrogen gas are at the same temperature. The molecules of the two gases have on average the same

A. velocity.
B. momentum.
C. force.
D. potential energy.
E. translational kinetic energy.

14. The three figures 1, 2, 3, give the graphical construction for image O' of object O as produced by the thin lens L with foci F and F'.



Which, if any, of these three figures are correct?

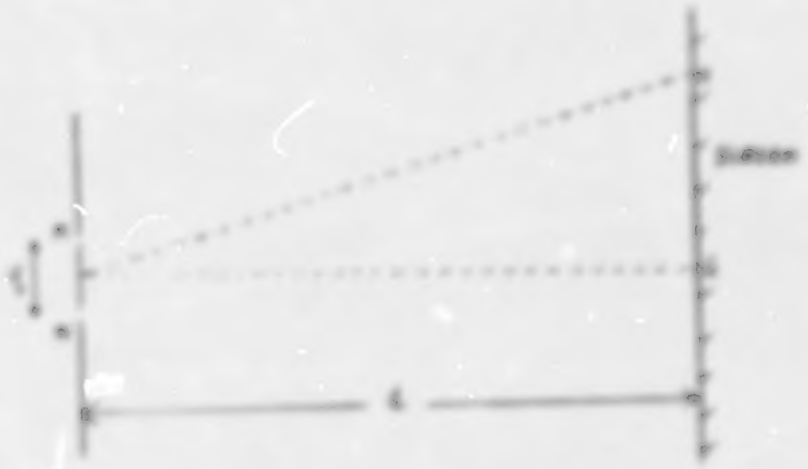
A. Figures 2 and 3 are correct.
B. Figures 1 and 3 are correct.
C. Figures 1 and 2 are correct.
D. None of the figures are correct.
E. All three figures are correct.

15. Sound is not an electromagnetic radiation. The best evidence for the truth of this statement is the fact that

A. audible sounds have a wavelength (in air) of about 1 m (about middle E).
B. diffraction effects can be observed.
C. sound can be produced by vibrating solids.
D. sound travels at 300 m/s in air.
E. sound can be refracted.

16. Two long narrow slits, P and R, are sources of monochromatic light and the light waves emerging from them are in phase.

A screen is placed parallel to the slits and at a distance d from them, where d is very large compared to a, the distance between them. The point S on the screen is equidistant from the mid-points of the two slits.



If there is a point X on the screen such that the difference between the distances from each slit to X is equal to λ, where λ is the wavelength of the light, one would expect to see in the vicinity of X

A. an interference pattern.
B. a boundary between a bright and a dark band, passing through X.
C. a dark band, centred on X.
D. a bright band centred on X.
E. a white band over X.

17. The sketch shows the pattern of circular waves produced by a moving source S in a tank of water. Given that sound can be described as a wave motion and that the pitch of a particular sound increases with frequency, which of the following phenomena might be predicted from this pattern?

A. The intensity of sound from a moving source varies inversely as the square of the distance from the source.
B. The pitch of a musical note from a vibrating string varies with the tension of the string.
C. The sound of a passing automobile horn to an observer by the side of a road drops in pitch as the car passes.
D. The velocity of propagation of sound never increases without a change in pitch as the sound passes into a denser medium.
E. The second harmonic is equal to twice

A. of the same shape and size as the wedge used.
B. widened uniformly by diffraction.
C. narrowed uniformly by diffraction.
D. widened most at the bottom by diffraction.
E. narrowed most at the bottom by diffraction.

75. A ray of blue light passes through a stack of three parallel-sided blocks made of different materials. The path of the ray is shown. In which of the three blocks is the velocity of blue light greatest?

A. I.
B. II.
C. III.
D. The velocity is the same in all the blocks.
E. The information given is insufficient to be able to say.

76. Sound waves of a in length are carried by a wire to two rubber tubes. With which of the following combinations of tube-lengths will the sea bear an image?

A. $\frac{3}{2}a$, $1\frac{3}{2}a$.
B. $\frac{3}{2}a$, $2\frac{1}{2}a$.
C. $1a$, $2\frac{3}{2}a$.
D. $1\frac{1}{2}a$, $2\frac{1}{2}a$.
E. $2a$, $2a$.

[illegible]

27. [illegible] instructions [illegible] [illegible] [illegible]

[illegible]

[illegible] Figure shows a circuit in which the current I is divided into a two branches and then combined. The two branches, X and Y are in parallel which connected to voltage V, while a potentiometer R and ammeter A are connected in series with X. If the resistance of the potentiometer is varied, [illegible] the ammeter A and voltmeter V are connected [illegible] the resistance of X and Y. If [illegible] is made [illegible] the resistance of the potentiometer is increased, [illegible] the ammeter reading [illegible] the voltmeter reading [illegible].

Which of the following statements is true?

A. [illegible] the current flowing through X [illegible] the current flowing through Y.
B. [illegible] the current flowing through X [illegible] the current flowing through Y.
C. The current flowing through X is [illegible] the current flowing through Y.
D. The current flowing through X is [illegible] the current flowing through Y.
E. The reading of [illegible] the reading of the voltmeter [illegible] the reading of the voltmeter is zero.
F. The reading of [illegible] the reading of the voltmeter [illegible] the reading of the voltmeter is zero.

[illegible] The electrostatic [illegible] and [illegible] from the same point by connecting [illegible] of equal length and [illegible] to [illegible] and [illegible] which [illegible] with the [illegible]. What can be said of the [illegible]?

A. Their masses and charges are equal.
B. Their masses are equal, the charges may or may not be.
C. Their charges are equal, the masses may or may not be.
D. The ratio of charge to mass is the same for the two [illegible].
E. The electrons travel at [illegible] speed.

[illegible]

21. [illegible]

[illegible]

(a) [illegible]
(b) [illegible]
(c) [illegible]
(d) [illegible]
(e) [illegible]

22. [illegible]

Fig. 3

Fig. 4

[illegible]

[illegible]

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38. Suppose there is an isolated mercury atom, initially at rest, which emits a photon of frequency ν and wavelength λ. Immediately after emission of the photon, it is certain that the mercury atom will

A. be ionised.
B. be in the ground state.
C. have at least one electron in the highest energy level.
D. emit an electron.
E. have at least one electron which is in a lower energy level than it was before.

- - - - - - - - - - - - - - - - - -

39. An atom with atomic number Z and atomic mass (mass number) W changes into one with atomic number Z + 1 and atomic mass W. Which of the following nuclear changes could have taken place?

A. The emission of an alpha particle.
B. The emission of a beta particle.
C. The emission of gamma rays.
D. The absorption of a deuteron and then emission of a neutron.
E. The absorption of a neutron and the emission of a gamma photon.

40. If a photon collides with a free electron

A. energy is conserved; momentum is not.
B. momentum is conserved; energy is not.
C. both energy and momentum are conserved.
D. neither energy nor momentum need be conserved.
E. momentum is conserved; the nature of the collision determines whether energy is conserved.

END OF BOOKLET 17

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The basic procedures to be followed in the main testing of the IEA Six-Subject Survey were set out in a series of manuals:

Stage 2 IEA/M1 Manual for National Centers
IEA/M2 Manual for School Coordinators
IEA/M3 Manual for Test Administrators

Stage 3 IEA/M1/Stage 3 Manual for National Centers
IEA/M2/Stage 3 Manual for School Coordinators
IEA/M3/Stage 3 Manual for Test Administrators

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1: Type of Instrument

E = Examination (student)
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S = School questionnaire

2: Student Population

1 = I
2 = II
3 = III
4 = IV
5 = I and II
6 = II and IV
7 = I, II and IV
8 = I and IV
S = IV Specialist
N = NA: Teacher or School questionnaire

3: Subject

S = Science
R = Reading Comprehension
L = Literature
M = Mother Tongue (Reading Comprehension and Literature)
E = English as a Foreign Language
F = French as a Foreign Language
C = Civic Education
2 = All Stage 2 Subjects
3 = All Stage 3 Subjects
5 = All Stage 2 and Stage 3 Subjects

4-5: Instrument Within Type

One or two characters used when necessary to uniquely identify each instrument when there is more than one instrument of the same type.

Instrument Name Science Practical II

Data Bank Instrument Number E2SX

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Practical tests were used only in Japan Population II and England Populations II and IV. These data will not be documented in the Six-Subject Data Bank.

POPULATION II SCIENCE PRACTICAL (National Options)

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This test is concerned with some of the practical abilities that are important in science, such as being able to read instructions and carry out simple manipulations, to observe accurately and record observations in an appropriate way, and to select the best method and equipment for a particular purpose.

The questions will ask you to carry out instructions and to observe and record the results.

In most questions you are asked to choose the best answer from a number of alternatives and to circle the letter corresponding to it.

Here is an example.
Which one of the following would you use to weigh a large crystal of copper sulphate to an accuracy of 0.01 gram?

A. A measuring cylinder.
B. A compression spring balance reading in 0.5 Kg. to 10.0 Kg.
C. A set of household (kitchen) scales.
(D) A chemical balance.
E. A milliammeter.

A measuring cylinder is used to measure volume, not weight. Similarly, a milliammeter is used to measure small electric currents. Hence we are left with B, C, and D, all of which are used for measuring weight. But, of these, only the chemical balance would be capable of weighing a crystal to 0.01 gram, so that is the correct answer and the D should be circled as shown.

In these questions you will have to make measurements or other observations and record the results in a different way. All you have to do is to follow the instructions carefully.

You will have plenty of time, so do not hurry. But you will have to plan your work and to organise your time efficiently as, of course, the ability to do this is an important part of laboratory work.

Do not waste time on questions you do not understand or cannot do. Leave them and pass on to the next ones: you can always come back to those you leave later if there is time.

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Questions 1, 2 and 3 refer to the following outline shape.

The outline shown above represents a leaf, the area of which is to be determined.

Using the scissors provided, cut out the shape very carefully so that the cut-out has a thin black margin all round the edge.

Place the cut-out shape on the graph paper which is printed at the end of this question. Hold it flat. Use a sharp pencil to draw a thin line round the shape as close as you can to its edge. The pencil should be touching the edge of the cut-out shape all the time as you draw round it.

1. Count the number of complete squares inside the outline and circle the letter corresponding to the number you obtain. The number of complete squares inside the outline is between

   A. 67 and 76
   B. 77 and 86
   C. 87 and 96
   D. 97 and 106
   E. 107 and 116

2. Count the number of part squares inside the outline and circle the letter corresponding to the number you obtain. The number of part squares inside the outline is between

   A. 55 and 64
   B. 65 and 74
   C. 75 and 84
   D. 85 and 94
   E. 95 and 104

3. Add the number of complete squares which you counted for question 1, to half the number of part squares you counted for question 2. Circle the letter corresponding to the resulting sum.

   The resulting sum, which represents the area of the leaf shape is between

   A. 121 and 125 square units
   B. 126 and 130 square units
   C. 131 and 135 square units
   D. 136 and 140 square units
   E. 141 and 145 square units

   Leave your cut-out shape pinned to the graph paper.

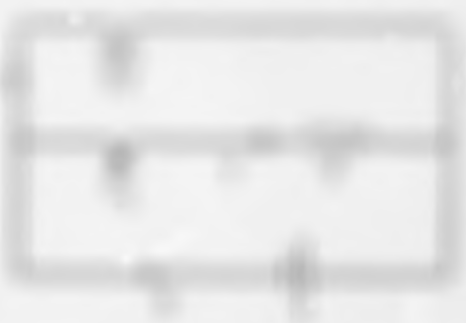
[illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible] [illegible] [illegible] [



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4-5: Instrument Within Type

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Instrument Name Science Practical IV

Data Bank Instrument Number E4SX

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Practical tests were used only in Japan Population II and England Populations II and IV. These data will not be documented in the Six-Subject Data Bank.

POPULATION IV SCIENCE PRACTICAL (National Option)

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The questions will ask you to carry out instructions and to observe and record the results.

In most questions you are asked to choose the best answer from a number of alternatives and to circle the letter corresponding to it.

Here is an example.

Which one of the following would you use to weigh a large crystal of copper sulphate to an accuracy of 0.01 gram?

A. A measuring cylinder
B. A compression spring balance reading in 0.5 Kg to 10.0 Kg
C. A set of household (kitchen) scales
(D). A chemical balance
E. A milliammeter

A measuring cylinder is used to measure volume, not weight. Similarly, a milliammeter is used to measure small electric currents. Hence we are left with B, C and D, all of which are used for measuring weight. But, of these, only the chemical balance would be capable of weighing a crystal to 0.01 gram, so that is the correct answer and the D should be circled as shown.

In these questions you will have to make measurements or other observations and record the results in a different way. All you have to do is to follow the instructions carefully.

You will have plenty of time, so do not hurry. But you will have to plan your work and to organise your time efficiently as, of course, the ability to do this is an important part of laboratory work.

Do not waste time on questions you do not understand or cannot do. Leave them and pass on to the next ones; you can always come back to those you leave later if there is time.

E4SX

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Questions 1 to 3 refer to the following experiment which you are required to do.

You are provided with a small quantity of organism F, a beaker of warm water (roughly 45°C), and three labelled tubes. One of these tubes contains a liquid that is poisonous to the organism, one contains a nutrient solution and the third contains distilled water but you are not told which.

Read carefully through the whole of the question before you begin work.

Divide the sample of organism F into <u>three</u> approximately equal portions. Place one portion in each of the tubes P, Q and R. Shake each tube vigorously for a few seconds so that the organisms are evenly dispersed in the liquid. (It is best to place your thumb over the mouth of the tube while doing this, but wipe it dry before moving from one tube to another).

Stand all three tubes in the beaker of warm water.

Shake the tubes gently occasionally but take care that none of the mixture spills out. After five minutes examine each tube.

Select from the following list of observations the one which you think best describes what you observed in each case.

A. No observable change occurred in the solution.
B. The solution became hot.
C. Gas bubbles were produced.
D. Gas bubbles were produced and the solution markedly changed colour.
E. The solution became hot and gas bubbles were produced.

1. The statement that best describes what happened in tube P is

   A. B. C. D. E.

2. The statement that best describes what happened in tube Q is

   A. B. C. D. E.

3. The statement that best describes what happened in tube R is

   A. B. C. D. E.

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Now take tube [illegible] and put half its contents into tube F and half into tube H. Again stand the tubes in the warm water in the beaker, shaking them gently occasionally. After five minutes examine the contents.

4. The statement that best describes what has now happened in tube F is

A. B. C. D. E.

5. The statement that best describes what has now happened in tube H is

A. B. C. D. E.

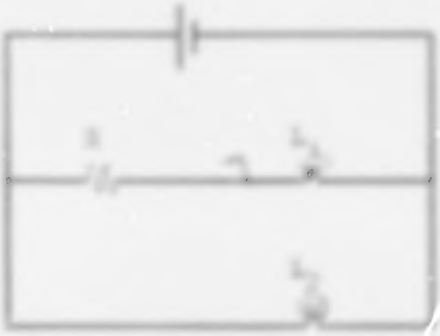
In question 6 select from the following list of observations those which you believe are most applicable to the experiments which you are asked to carry out:

A. Solid dissolves
B. Solid does not dissolve
C. Black precipitate forms
D. White precipitate forms
E. Red-brown precipitate forms
F. Green-grey precipitate forms
G. Precipitate dissolves later
H. Precipitate does not dissolve
I. Colourless solution forms
J. Greenish yellow solution forms
K. White needle-shaped crystals form
L. No residue
M. Black residue
N. Pale yellow residue
O. Colourless droplets form
P. White steamy fumes evolved
Q. Solid sublimes
R. Pungent gas evolved
S. No gas evolved
T. Green-yellow gas evolved
U. Inflammable gas evolved
V. Gas evolved which relights a glowing splint

6. Heat separately each of the substances [illegible] and [illegible] with liquid W until no further change occurs and then cool. Do not boil. Use about as much of [illegible] or [illegible] as will pile on this circle ○ and about 0.5 cm³ of W. Complete the following table for both [illegible] and [illegible] Letters selected from A to V above are to appear in each blank space, representing what you think are the [illegible] most appropriate observations in each case.

Substance treated with solution W	Observations
[illegible]	
[illegible]	

7. Set up the circuit as shown in the diagram from the apparatus provided.



Using the voltmeter or the ammeter as necessary, measure the following and record your results in the spaces provided.

I The voltage across L_1 _____

II The voltage across L_2 _____

III The voltage across S _____

IV The voltage across the accumulator _____

V The current taken from the accumulator _____

VI The current through L_1 _____

VII The current through L_2 _____

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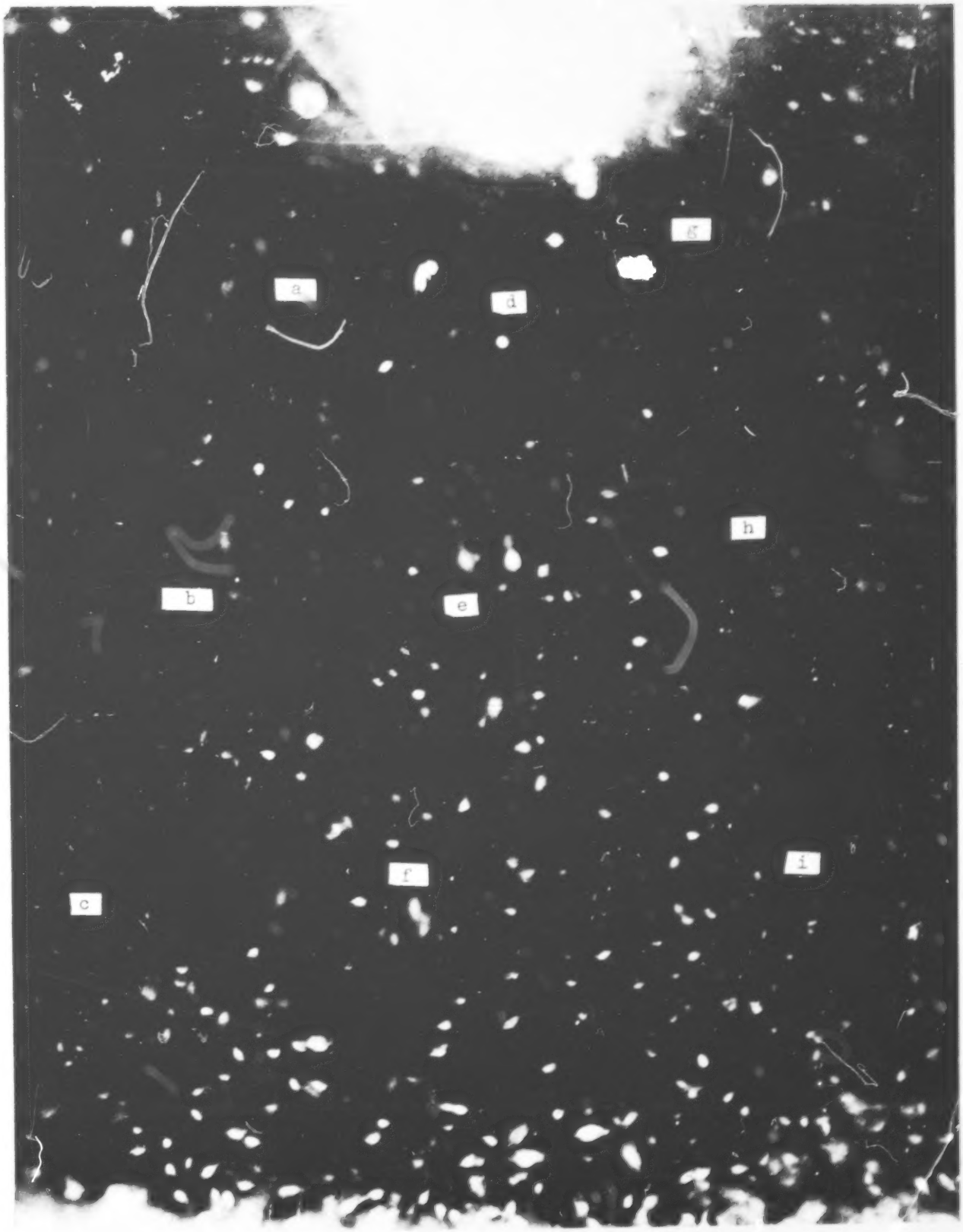

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Questions 6, 7 and 8 refer to the photograph.

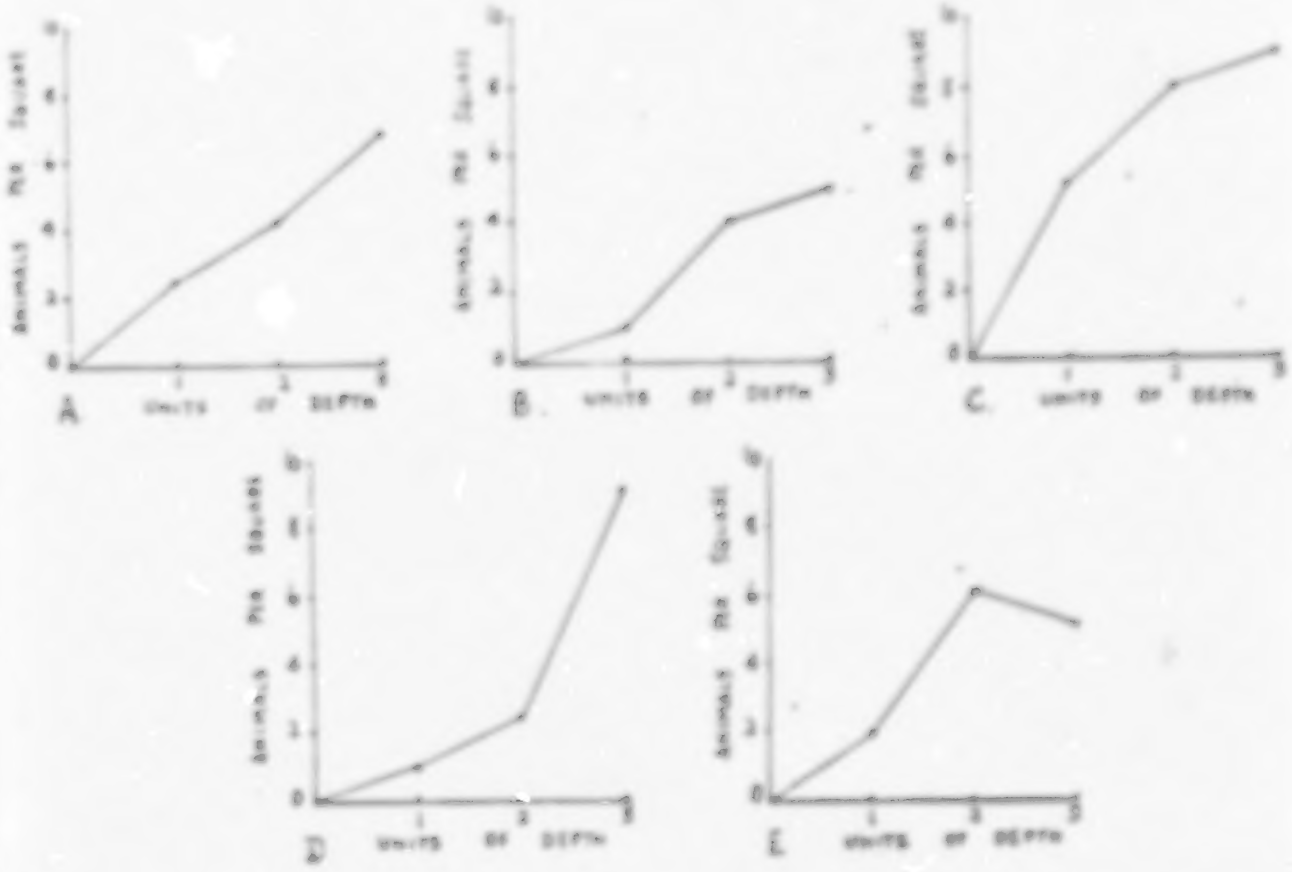
The photograph on page 5 shows the distribution of small organisms in a container of water when illuminated from above by a bright source of light.

6. In order to obtain the best estimate of the numbers of organisms at different light intensities it would be necessary to count the numbers present per unit area on the photograph at the following positions: (circle one)

   A. Either points a, b and c, or points d, e and f or points g, h and i.
   B. At three points chosen at random from a, b, c, d, e, f, g, h, or i.
   C. Along the diagonals points a, e, and i, or points g, e, and c, that is, across the rows but at different distances from the light source.
   D. At positions a, d and g; positions b, e and h and at positions c, f, and i.
   E. None of these.

7. Cut a 2.5 cm square hole in a piece of paper. Place the top left-hand corner of the square hole against the bottom right-hand corner of the label h on the photograph so that the sides of the hole are parallel to the sides of photograph. Count the number of organisms in the square hole. (N.B. Any light spot is an individual animal).
   Repeat this process at positions e and h.
   The average number of animals per 2.5 cm square of photograph at these points is

   A. 3.
   B. 5.
   C. 7.
   D. 9.
   E. 12.



8. Which of the above graphs most accurately represents the variation of density of animals (measured as number of animals per unit area) at different depths. The position of a is at 1 unit of depth, the position of b at 2 units of depth and the position c at 3 units of depth.

A. Graph A
B. Graph B
C. Graph C
D. Graph D
E. Graph E

POPULATION IV CHEMISTRY PRACTICAL (National Option)

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This test is concerned with some of the practical abilities that are important in science, such as being able to read instructions and carry out simple manipulations, to observe accurately and record observations in an appropriate way, and to select the best method and equipment for a particular purpose.

The questions will ask you to carry out instructions and to observe and record the results.

In most questions you are asked to choose the best answer from a number of alternatives and to circle the letter corresponding to it.

Here is an example.

Which one of the following would you use to weigh a large crystal of copper sulphate to an accuracy of 0.01 gram?

A. A measuring cylinder
B. A compression spring balance reading in 0.5 Kg to 10.0 Kg
C. A set of household (kitchen) scales
(D) A chemical balance
E. A milliammeter

A measuring cylinder is used to measure volume, not weight. Similarly, a milliammeter is used to measure small electric currents. Hence we are left with B, C and D, all of which are used for measuring weight. But, of these, only the chemical balance would be capable of weighing a crystal to 0.01 gram, so that is the correct answer and the D should be circled as shown.

In these questions you will have to make measurements or other observations and record the results in a different way. All you have to do is to follow the instructions carefully.

You will have plenty of time, so do not hurry. But you will have to plan your work and to organise your time efficiently as, of course, the ability to do this is an important part of laboratory work.

Do not waste time on questions you do not understand or cannot do. Leave them and pass on to the next ones; you can always come back to those you leave later if there is time.

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In questions 1, 2 and 3 select from the following list of observations those which you believe are most appropriate to the experiments which you are asked to carry out.

A. Solid dissolves
B. Solid does not dissolve
C. Black precipitate forms
D. White precipitate forms
E. Red-Brown precipitate forms
F. Green-grey precipitate forms
G. Precipitate dissolves later
H. Precipitate does not dissolve
I. Colourless solution forms
J. Greenish yellow solution forms
K. White needle-shaped crystals form
L. No residue
M. Black residue
N. Pale yellow residue
O. Colourless droplets form
P. White steamy fumes evolved
Q. Solid sublimes
R. Pungent gas evolved
S. Brown gas evolved
T. Green-yellow gas evolved
U. No gas evolved
V. Gas evolved which relights a glowing splint

1. Heat separately each of the substances α and β with liquid W until no further change occurs and then cool. Do not boil. Use about as much of α or β as will pile on this circle ◯ and about 0.5 cm^3 of W. Complete the following table for both α and β; 4 letters selected from A to V above are to appear in each blank space, representing what you think are the 4 most appropriate observations in each case.

Substance treated with solution W	Observations
α	
β	

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2. Heat solid substance Y carefully in an ignition tube until no further change occurs. Use about the quantity of crystals which would pile on this circle

Circle the four most appropriate letters which represent your observations, that is 4 of the following letters should be circled.

A B C D E F G H I J K

L M N O P Q R S T U V

3. Add dilute sodium hydroxide solution slowly to each of tubes X, Y and Z until it is present in excess in each case. Complete the following table for each tube; one letter selected from A to V above is to appear in each blank space, each pair representing what you think are the two most appropriate observations in each case.

Tube	Observations	
X		
Y		
Z		

END OF BOOKLET 22

E49XC

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PRACTICAL TESTS

The limited pre-testing of practical items (ST 2 and 3) we were able to do and the comments we have received from National Centers and the other sources have confirmed the view that certain practical skills and abilities desirable in science education can be tested by our testing instruments.

Accordingly, as you know, we have included some "pencil and paper practical items" in tests IIA (IEA/44), IIP (IEA/43) and IVA (IEA/103) Science, and we are offering further tests, which require a very modest amount of equipment, as a national or school option. In this way we hope to obtain information, not only about achievement in science under varying school conditions, but also about the effectiveness of different kinds of test items.

The tests being offered as National Options are

II	Science Practical	1 1/2	hours
IV	Science Practical	1 1/2	hours
IV	Biology Practical	1	hour
IV	Chemistry Practical	1	hour
IV	Physics Practical	1	hour

More time has been allowed than is likely to be needed by the students to carry out the actual operations. This has been done to allow time for the general organisation of the test and to remove from the students any sense of pressure.

The behavioural categories of the practical items can be expressed as follows.

I The ability to use simple apparatus and to implement simple procedures.

II The ability to observe changes/differences in structures or systems under investigation and to record such changes/differences in ways that yield maximum relevant information.

III The ability to select appropriate apparatus and/or procedures for a novel experimental problem.

The attached note sets out the information that should be given to schools concerning the conditions and materials required for the tests and the conduct of the actual testing.

The tests should be scored by the schools and the scores checked by National Centers.

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We shall be grateful if you will let us know as soon as possible if you intend to carry out science testing in practical abilities.

Note on practical tests to be sent by National Centers to participating schools

These tests of practical abilities important in the learning of science are part of an international study and have been so designed as to require only the simplest of facilities and materials and to need very little in the way of preparation by the teacher.

The provision of a laboratory or a practical room is not essential, but each student should have an adequate area of suitable, flat-topped working space and to have reasonable access to water (for washing up etc.) and to places for the disposal of solid and liquid wastes.

For some tests gas (or some equivalent) for heating will be required.

In some cases, marked * in the appended lists, one set of apparatus can be used for up to five or six students, but if this is done the apparatus must be disconnected and restored to its original position before each new student begins that section of the test. The student should not, of course, be told what the various substances and materials are.

There should be a clock with a sweep second hand (not a stop clock) so placed that all students can see it.

The tests should be marked according to the given schedules and returned to the National Centers.

Requirements for IV Practical Chemistry

Each student to have

one ignition tube

a bunsen (or similar) burner

a tube containing a small quantity of substance (lead II oxide PbO) labelled substance C

a tube containing a small quantity of substance (lead IV oxide PbO_2) labelled substance J

a tube containing a small quantity of substance (lead II nitrate $Pb(NO_3)$ crystals) labelled substance B

a lipped beaker (about 100 cm^3) containing approximately 5 M HCl and labelled liquid W

a tube containing 3 cm^3 of solution (approximately 1 M iron III chloride $FeCl_3$) labelled X

a tube containing 3 cm^3 of solution (approximately 1 M zinc sulphate $ZnSO_4$) labelled Y

- a tube containing 2 cm³ of solution (approximately 1 M magnesium sulphate ($MgSO_4$) labelled 2

- small lipped beaker containing about 100 cm^3 of approximately 2 M sodium hydroxide solution labelled as such

- mask for test tubes

- splint for testing for oxygen

The basic procedures to be followed in the main testing of the IEA Six-Subject Survey were set out in a series of manuals:

Stage 1 [illegible] Manual for Testing Centres
[illegible] Manual for School Coordinators
[illegible] Manual for Test Administrators

Stage 2 [illegible] Stage 2 Manual for National Ctr' ers
[illegible] Stage 2 Manual for School Coordinators
[illegible] Stage 2 Manual for Test Administrators

These manuals were available from [illegible] Clearinghouse.

The following extracts from these manuals have been reproduced to help participating IEA instrument to provide researchers with the minimum necessary text to understand information (e.g., such things as the instructions on the practice items) and the warnings concerning the secrecy of item pools. For the test items themselves omitted. For full details, please consult the appropriate manuals.

The Data Base Instrument Number which appears below is a new number, modelled since the instruments were administered. For the purpose of easily identifying which in the instruments with the smallest variations in the Data Base arrangement. Each such variable is named in the codebook using the new instrument number + and (usually) the number of the item within the instrument from which the variable is derived. The key to the new instrument numbers is as follows:

1: Type of Instrument

S = Examination (student)
Q = Questionnaire (student)
T = Teacher questionnaire
S = School questionnaire

2: Student Population

1 = I
2 = II
3 = III
4 = IV
5 = I and II
6 = V
7 = [illegible] IV and IV
8 = [illegible] I and IV
9 = [illegible] Specialist
0 = All Teacher or School questionnaire

3: Subject

1 = Science
2 = Reading Comprehension
3 = Literature
4 = Mother Tongue (Reading Comprehension and Literature)
5 = English as a Foreign Language
6 = French as a Foreign Language
7 = Civic Education
8 = All Stage 1 Subjects
9 = All Stage 2 Subjects
0 = All Stage 1 and Stage 2 Subjects

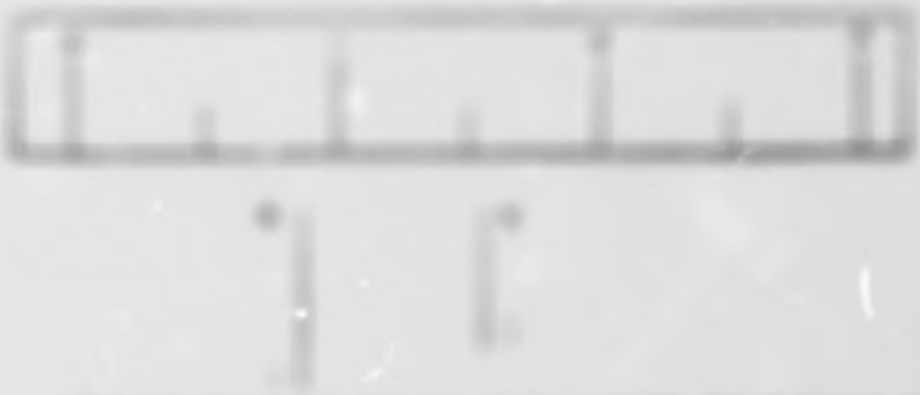
4-5: Instrument Within Type

One or two characters used where necessary to uniquely identify each instrument when there is more than one instrument of the same type.)

Instrument Name: [illegible]

Data Base Instrument Number: [illegible]

[illegible] 1, 2, 3 and 4 refer to the problems solved above.



For each the point A(1 and 2) is assumed. The distances between the steps, B and C, are 1, 2, 3 and 4 feet [illegible].

1. The distance between the two steps is

   A. 1.7 [illegible] units
   B. 1.12 [illegible] units
   C. 1.73 [illegible] units
   D. 1.17 [illegible] units
   E. 1.14 [illegible] units

2. The coordinates of the intersection [illegible] are

   A. 1.7
   B. 1.12
   C. 1.73
   D. 1.17
   E. 1.14

3. If an experiment [illegible] were [illegible] [illegible] and measures with [illegible] [illegible] [illegible] of the [illegible] of problems 1, 2, 3, and 4. The [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

   a. [illegible] the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

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IEA SIX-SUBJECT SURVEY INSTRUMENTS

The basic procedures to be followed in the main testing of the IEA Six-Subject Survey were set out in a series of manuals:

Stage 2 IEA/M1 Manual for National Centers
IEA/M2 Manual for School Coordinators
IEA/M3 Manual for Test Administrators

Stage 3 IEA/M1/Stage 3 Manual for National Centers
IEA/M2/Stage 3 Manual for School Coordinators
IEA/M3/Stage 3 Manual for Test Administrators

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These manuals are available from ERIC Clearinghouse.

The following extracts from these manuals have been appended to this particular IEA instrument to provide researchers with the minimum necessary test instruction information (e.g., such things as the instructions on the practice items and the warnings concerning the amount of time left for the test have been omitted here). For full details, please consult the appropriate manuals.

The Data Bank Instrument Number which appears below is a new number, assigned since the instruments were administered for the purpose of easily linking items in the instruments with the resultant variables in the Data Bank holdings. Each such variable is named in the codebook using the new instrument number and (usually) the number of the item within the instrument from which the variable is derived. The key to the new instrument numbers is as follows:

1: Type of Instrument

E = Examination (student)
Q = Questionnaire (student)
T = Teacher questionnaire
S = School questionnaire

2: Student Population

1 = I
2 = II
3 = III
4 = IV
5 = I and II
6 = II and IV
7 = I, II and IV
8 = I and IV
S = IV Specialist
N = NA: Teacher or School questionnaire

3: Subject

S = Science
R = Reading Comprehension
L = Literature
M = Mother Tongue (Reading Comprehension and Literature)
E = English as a Foreign Language
F = French as a Foreign Language
C = Civic Education
2 = All Stage 2 Subjects
3 = All Stage 3 Subjects
5 = All Stage 2 and Stage 3 Subjects

4-5: Instrument Within Type

One or two characters used when necessary to uniquely identify each instrument when there is more than one instrument of the same type.

Instrument Name TOUS-Understanding the Nature of Science

Data Bank Instrument Number E2SN

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IEA/M3
Pop II, p. 6-7

"We are now ready to start Section T. The questions in this section deal with how scientists work. In answering the questions, read each question, choose the best answer and mark your choice in Section T on the answer card. Are there any questions?"
Make sure that students understand what they are to do.
Then say:-
"Begin working."
After 10 minutes say:-
"About half the time has gone. Remember, do not waste time on the questions you do not know how to do."
After 20 minutes says:-
"Stop working and put your pencils down."

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UNDERSTANDING THE NATURE OF SCIENCE

1. Modern scientists can solve more complicated problems than the scientists of the past because they

   A. know that many of the ideas of earlier scientists were wrong.
   B. have more imagination than earlier scientists.
   C. can build on the ideas and discoveries of earlier scientists.
   D. are more intelligent than earlier scientists.
   E. receive a better education than earlier scientists.

2. Betty is planning an experiment on the conditions required for seeds to germinate. She knows that they need water and air and thinks that warmth and light may also be necessary. She plans to set up one experiment in which seeds of various kinds are given water and air in a warm light place.
   What other experiments should she set up?

   A. One other in which the seeds are without water and air and are kept in a cold, dark place.
   B. One other in which the seeds are without water and air and are kept in a cold, light place.
   C. One other in which the seeds have water and air and are kept in a cold, dark place.
   D. Two others; one in which the seeds have water and air and are kept in a cold, light place, and one in which the seeds have water and air and are kept in a warm, dark place.
   E. Two others, one in which the seeds have water and air and are kept in a cold, dark place and one in which the seeds are without water and air and are kept in a warm, light place.

3. All the following play some part in scientific discovery, but one of them is more characteristic of scientific investigation than the others. Which one is it?

   A. Measurement and calculation.
   B. Using complicated apparatus.
   C. Making experimental measurements more accurate.
   D. Checking through the work of earlier scientists.
   E. Testing ideas by observation and experiment.

4. Scientific discoveries have come from
   A. many countries of the world.
   B. only countries with big industries.
   C. only countries with large populations.
   D. almost all the countries with free education for all.
   E. only countries where the governments finance research.

5. In the past, important scientific discoveries were made by clergymen, statesmen, businessmen, and others who worked on science as amateurs. Why is this less true today?

A. Men in other professions are less interested in science today than they used to be.
B. Scientific research today requires many years of specialised preparation and training.
C. Important discoveries cannot be made today without expensive equipment, which only scientists possess.
D. Only professional scientists have the abilities needed to make important discoveries.
E. Everyone now has to work so hard at his own job that there is not time to work on science as an amateur.

6. We do experiments when we are learning science because

A. experiments are used to test ideas by experience.
B. experiments enable us to learn better.
C. experiments make learning more interesting.
D. we can show that we all get the same results.
E. it is important to learn to handle apparatus skilfully.

7. Why should one make a written note of all the observations made when carrying out a scientific investigation?

A. One might forget them, and they may turn out to be important later.
B. It is a good way to train powers of observation.
C. It trains one to think clearly and write accurately.
D. Good scientists always do it.
E. One is supposed to have a complete record of what one has done.

8. Which of the following is the most complete statement of what scientists <u>study</u>?

A. Atoms, radiations, life.
B. Substances, energy, living things.
C. Matter, space, waves.
D. Plants, animals, micro-organisms.
E. Molecules, earth, stars.

9. Which one of the following is the best description of a scientific experiment?

A. Measurements made to find the value of a physical constant to a greater degree of accuracy.
B. Observations made to learn more about natural phenomena.
C. Observations made under controlled conditions to test a given hypothesis.
D. Studies made with scientific equipment to verify natural laws.
E. Measurements made under specified conditions to support crude, unaided observations.

10. A scientist predicted that an experiment would come out in a certain way. When he did the experiment, the result was different from what he expected. As a scientist, which of the following would be his most likely reaction?

A. "I should not have made a prediction before trying out the experiment."
B. "I will improve the experiment and make it come out in the way I predicted."
C. "If I had better equipment for the experiment, I would get the right results."
D. "If I practice long enough, it will come out in the way I want it to."
E. "Something was wrong either with my prediction, the experiment, or my observations."

11. When new evidence that does not fit into a well-established scientific theory appears, which one of the following do scientists usually do?

A. Discard the theory and produce a new one.
B. Modify the evidence in such a way that it does fit the theory.
C. Keep the theory because it has proved useful and ignore the new evidence.
D. Change the theory in such a way that the evidence can fit it.
E. Design experiments to refute the new evidence.

12. The test of the validity of a scientific theory is that the theory

A. makes it easy to understand the world we live in.
B. stimulates further scientific investigation.
C. gives a simple picture of a complicated pattern of natural events.
D. makes a clear distinction between what are facts and what are beliefs.
E. explains all the known facts related to certain phenomena.

13. An astronomer in Australia reports that he has seen evidence of plant growth on the planet Venus. Scientists will accept this report as important evidence if

A. other independent observations confirm the report.
B. the species of plants have been identified.
C. the Australian government certifies the observation as correct.
D. other astronomers agree that there is oxygen on Venus.
E. the astronomer in Australia is a biologist as well as an astronomer.

16. Which of the following is the principal aim of scientific investigation?

A. To verify what has already been discovered about the physical universe.
B. To describe and explain natural phenomena in terms of principles and theories.
C. To discover, collect and classify as many facts as possible about immediate and private matters.
D. To provide the people of the world with the means for leading happier lives.
E. To make the world more technologically advanced and to do without hard physical labour.

17. John Smith is a very imaginative young person. If he does not become a scientist, what is the most likely explanation?

A. He might not want to give up his freedom of thought.
B. Imaginative people usually become artists or writers.
C. He might like some other field of work better than science.
D. Science is too factual and gives no scope for the imagination.
E. A scientist has to be objective which is impossible if one is imaginative.

The Six-Subject Study Instruments

The basic procedures to be followed in the main testing of the IEA Six-Subject Survey were set out in a series of manuals:

Stage 1	IEA/SS	Manual for National Centres
	IEA/SC	Manual for School Coordinators
	IEA/SI	Manual for Test Administrators
Stage 2	IEA/SS/Stage 2	Manual for National Centres
	IEA/SC/Stage 2	Manual for School Coordinators
	IEA/SI/Stage 2	Manual for Test Administrators

These manuals are available from SIMS Clearinghouse.

The following extracts from these manuals have been appended to this publication in order to provide researchers with the minimum necessary test instrument information (e.g., such things as the instructions on the practice items and the warnings concerning the amount of time left for the test have been deliberately omitted). For full details, please consult the appropriate manuals.

The Data Bank Instrument Number which appears below is a new number, developed since the instruments were administered for the purpose of easily linking items in the instruments with the equivalent variables in the Data Bank bibliography. Each such variable is named in the codebook using the new instrument number as its (usually) the number of the item within the instrument from which the variable is derived. The key to the new instrument numbers is as follows:

1- Type of Instrument

- 0 = Examination (student)
- 4 = Questionnaire (student)
- 7 = Teacher questionnaire
- 8 = School questionnaire

2- Student Population

1 = I	6 = II and IV
2 = II	7 = I, II and IV
3 = III	8 = I and IV
4 = IV	9 = IV Specialist
5 = I and II	0 = 4a: Teacher or School questionnaire

3- Subject

- 1 = Science
- 2 = Reading Comprehension
- 3 = Literature
- 4 = Mother Tongue (Reading Comprehension and Literature)
- 5 = English as a Foreign Language
- 6 = French as a Foreign Language
- 7 = Civic Education
- 8 = All Stage 1 Subjects
- 9 = All Stage 2 Subjects
- 0 = All Stage 1 and Stage 2 Subjects

4-5- Instrument Within Type

Two or ten characters were also necessary to uniquely identify each instrument when there is more than one instrument of the same type.

Instrument Name: Mathematics for Pupils of 13-Years

Data Bank Instrument Number: 7430

[illegible]

[illegible]

1. Which of the following is the best scientific description of most scientific work?

   a. [illegible]
   b. [illegible]
   c. [illegible]
   d. [illegible]
   e. [illegible]

2. Which of the following is the best description of a scientific law?

   a. [illegible]
   b. [illegible]
   c. [illegible]
   d. [illegible]
   e. [illegible]

3. [illegible] [illegible] [illegible]

[illegible]